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Long-Term Ecological Monitoring Field Sampling Plan for 2004

Thomas Haney
Robin VanHorn
Carolyn Fordham

Idaho Completion Project

Bechtel BWXT Idaho, LLC

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Idaho Falls, Idaho 83415

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ABSTRACT

This Field Sampling Plan for the Long-Term Ecological Monitoring (LTEM) Project describes the field investigations to be conducted at the Idaho National Engineering and Environmental Laboratory (INEEL) in 2004. This Field Sampling Plan and the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* constitute the sampling and analysis plan supporting LTEM sampling in 2004. The data collected under this plan will become part of the LTEM data set that will be collected annually. The data will be used to determine the requirements for the subsequent LTEM that might last for decades.

The primary goals of the LTEM Plan, in coordination with other INEEL monitoring plans, include the following:

- Verifying that the remedial objectives specified in INEEL Comprehensive Environmental Response, Compensation, and Liability Act Records of Decision are maintained for ecological receptors

- Determining that legacy contamination in the INEEL soils and waters does not have unacceptable long-term sitewide ecological impacts

- Identifying and quantifying adverse ecological effects, if any, resulting from INEEL contamination

- Providing information to support the selection and evaluation of appropriate ecological indicators for long-term monitoring.

This Field Sampling Plan provides guidance for the site-specific investigation in 2004, including sampling, quality assurance, quality control, analytical procedures, and data management. Use of this Field Sampling Plan helps ensure that the resulting monitoring data are scientifically valid, defensible, and of known and acceptable quality.

The areas to be characterized as part of this Field Sampling Plan include the Idaho Nuclear Technology and Engineering Center, TSF-07 disposal pond located at Test Area North, Ordnance Group #2 (Mass Detonation Area), and one terrestrial and one aquatic reference area at the INEEL. Both analytical and effects data will be collected during the 2004 field activities. Analytical data will include biotic (e.g., whole mice and plant tissues) and abiotic (e.g., soil) samples. Effects data collected will range from surveys of vegetative cover and small mammal population estimates to histopathology studies of captured mice.

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ACRONYMS

AA	alternative action
AOC	area of concern
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chain of custody
COPC	contaminant of potential concern
CPP	Chemical Processing Plant
DAR	Document Action Request
DOE	U.S. Department of Energy
DQO	data quality objective
DS	decision statement
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
ERA	ecological risk assessment
ESH&QA	environmental, safety, health, and quality assurance
FSP	Field Sampling Plan
FTL	field team leader
FY	fiscal year
GDE	guide
HMX	high melting point explosive
HSO	health and safety officer
ICPP	Idaho Chemical Processing Plant
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
JSA	job safety analysis
JSS	job site supervisor
LTEM	long-term ecological monitoring

MCP	management control procedure
MDA	Mass Detonation Area
NA	not applicable
NRF	Naval Reactors Facility
OU	operable unit
PLN	plan
PPE	personal protective equipment
PRD	program requirements document
QAPjP	quality assurance project plan
RCT	radiological control technician
RDX	Royal Demolition Explosive
SAM	Sample and Analysis Management
SOW	statement of work
TAN	Test Area North
T/E	threatened and/or endangered
TEM	template
TNT	trinitrotoluene
TPH	total petroleum hydrocarbon
TPR	technical procedure
TSF	Technical Support Facility
USC	United States Code
WAG	waste area group
WGS	Waste Generator Services

Long-Term Ecological Monitoring Field Sampling Plan for 2004

1. INTRODUCTION

This Field Sampling Plan (FSP) was prepared for the Long-Term Ecological Monitoring (LTEM) Project of the Idaho Completion Project at the Idaho National Engineering and Environmental Laboratory (INEEL). This plan identifies the characterization project activities, including the health and safety requirements required to perform these activities. This plan was prepared in accordance with the requirements outlined in INEEL Template (TEM) -104, "Model for Preparation of Characterization Plans"; Management Control Procedure (MCP) -9439, "Preparation for Environmental Sampling Activities at the INEEL"; and MCP-3562, "Hazard Identification, Analysis, and Control of Operational Activities."

1.1 Project Objectives

The objective of the FSP activities is to provide data and guidance for yearly sampling in accordance with the *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory* (INEEL 2004). The LTEM Plan presents the approach for LTEM to assess effects from contaminants at the INEEL that are covered under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.). The LTEM Plan approach is based on the results of the Operable Unit (OU) 10-04 Ecological Risk Assessment (ERA) presented in the *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04* (DOE-ID 2001). The OU 10-04 ERA was an INEEL-wide assessment with the primary purpose of evaluating risk to ecological receptors from contamination released to the environment from INEEL activities. The LTEM Plan was developed to meet the requirement of implementing Sitewide ecological monitoring set forth in the *Record of Decision Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites* (DOE-ID 2002a).

The LTEM Plan (INEEL 2004) calls for yearly sampling to support baseline contaminant characterization and collection of data in a comprehensive and systematic approach. Yearly sampling will provide the information needed to support the decision statements for CERCLA long-term monitoring at the INEEL.

A sampling schedule is presented in Table 2 of the LTEM Plan (INEEL 2004). Based on this schedule, two main terrestrial areas will be characterized in 2004: (1) the Idaho Nuclear Technology and Engineering Center (INTEC) and (2) Ordnance Group #2: the Mass Detonation Area (MDA).

Facilities at INTEC (a.k.a., Waste Area Group [WAG] 3) include spent fuel storage and former reprocessing areas, a waste solidification area and related waste storage bins, remote analytical laboratories, and a coal-fired steam-generating plant. Contamination release sites associated with various facilities at INTEC include sumps, ponds, injection wells, spills, and a tank farm used to store hazardous substances. Potential contaminants include organics, radionuclides, metals, corrosives, petroleum waste, and mixed waste.

The MDA is located 1.6 km (1 mi) east of Mile Marker 8 on Lincoln Boulevard. The area is north of INTEC and approximately 3.2 km (2 mi) east of the Naval Reactors Facility (NRF). The MDA encompasses 322 hectares (796 acres) and has been used for a number of small- to large-scale sympathetic and mass detonation tests with test shots ranging up to 500,000 lb of explosives. A sympathetic detonation test is used to find out if a charge explodes when another charge is detonated next

to it. The site includes numerous blast craters varying in dimensions from a few feet to several tens of feet and is littered with large quantities of unexploded ordnance, pieces of explosives, and structural debris scattered during past testing and recent ordnance detonation or disposal activities, or both (DOE-ID 1998).

As discussed in the LTEM Plan (INEEL 2004), the reference area will be sampled every year. Two locations were selected to collectively serve as the terrestrial reference area. The terrestrial reference locations match the geological, hydrological, and ecological conditions at the contaminated sites to the greatest extent possible. Reference area data serve to provide a baseline of natural, ambient conditions for all media in the absence of site-related contaminant impacts. Flora and fauna population data for selected species at these sites will be collected every year according to the LTEM Plan (INEEL 2004). This year, the reference area also will be characterized for contaminant concentrations in the media at the site.

As discussed in Table 2 of the LTEM Plan (INEEL 2004), sampling also will be performed at aquatic sites of concern. The Technical Support Facility (TSF) -07 disposal pond, located at Test Area North (TAN), will be sampled as the first aquatic site in 2004. The TSF-07 is an unlined disposal pond located southwest of the TSF. The pond began receiving wastewater in September 1972. The TSF-07 site encompasses a total area of approximately 14 hectares (35 acres), of which 2 hectares (5 acres) in the northeast corner and on the eastern edge is known to have concentrations of radionuclides and metals above background. Open water on the INEEL attracts wildlife such as deer, coyotes, waterfowl, and swallows. Maximum exposure to receptors from the disposal pond water will be analyzed by evaluating swallows, small mammals, and plants in the area. For comparison, one aquatic reference area will be evaluated. Mackay Reservoir is the likeliest candidate for use as an aquatic reference area, because it is easily accessible and is out of the prevailing wind pattern.

Mercury, radionuclides, and organic compounds have been measured in sediments and surface water at the waste ponds, which are potential exposure pathways for birds. Benthic invertebrates and aquatic plants can accumulate organics and inorganics, thus representing an additional exposure pathway. Birds will be collected around the waste ponds to determine if contact with organic or inorganic contaminants or radionuclides in surface water, sediments, or aquatic life (i.e., macroinvertebrates or aquatic plants) represents a potential health risk. Swallows are preferred, but red-winged blackbirds will be sampled if swallows are absent.

In addition, opportunistic collection of plants, soils, or small mammals may occur as determined by the technical lead. Opportunistic collection may include plants, soils, and animals exhibiting visual indicators of possible contaminant exposure. For example, in 2003 at the Test Reactor Area, the field team observed several mice that had facial defects. In 2004, the technical lead can send for laboratory analyses for any plant, soil, or small mammal exhibiting an indicator of possible effects from contaminant exposure.

As discussed in the LTEM Plan (INEEL 2004), the project was directed by the Record of Decision (DOE-ID 2002a) to conduct selected research studies, such as measuring effects to INEEL populations or individual species, to support the development and understanding of long-term trends in the INEEL's ecological communities. Two such studies will be conducted this year. The first is the comparison of a field-based radionuclide measurement system to laboratory results. Field methods are gaining acceptance as a complement to traditional laboratory analysis of radionuclide-contaminated material. The use of the INEEL field-based radionuclide measurement system in the future could reduce cost and provide rapid turnaround, thereby allowing for a larger number of analyses and providing better characterization of contaminated areas.

As discussed in Subsection 4.3.5.2 of the LTEM Plan (INEEL 2004), the second study selected is designed to assess chronic cumulative effects from radionuclides by measuring the microsatellites' mutation rate in burrowing mammals. This effort supports the establishment of a baseline and will evaluate the potential use of the microsatellites' mutation rate as a genetic marker for ecological receptors.

This FSP is implemented in accordance with the latest revision of the *Quality Assurance Project Plan for Waste Area Groups 1, 2, 3, 4, 5, 6, 7, 10, and Inactive Sites* (DOE-ID 2002b). The Quality Assurance Project Plan (QAPjP) and this FSP constitute the sampling and analysis plan for the 2004 LTEM sampling effort. This document governs all work performed by INEEL employees, subcontractors, and employees of other companies or U.S. Department of Energy (DOE) laboratories during sampling.

1.2 Site Description

The INEEL occupies about 2,305 km^2 (890 mi^2) of the northwestern portion of the Eastern Snake River Plain (see Figure 1-1). The Snake River Plain is about 97 km (60 mi) wide and over 600 km (370 mi) long. A few buttes exist on the INEEL, but most of the land is flat to a gently rolling, high-desert terrain that lies about 1,524 m (5,000 ft) above sea level.

The INEEL is a semiarid desert with a mean annual precipitation of less than 22 cm (9 in.) and with large daily and seasonal temperature fluctuations. In the winter, the temperature might not rise above freezing, and topsoils usually remain frozen from mid- to late November through early March. Snow cover typically persists for 2 to 3 months, but it is highly variable between years. During the summer, low humidity and clear skies result in relatively high maximum temperatures at 30 to 35°C (85 to 95°F) and at night temperatures drop to below 10°C (50°F).

Vast, primarily undeveloped sagebrush flats interrupted by basalt outcrops isolate the INEEL facilities. Because its border is secured, the INEEL is a refuge for plants and wildlife, and its core is arguably the largest area of undeveloped and ungrazed sagebrush steppe outside national parks in the Intermountain West. In addition, large numbers of raptors and mammals migrate onto the INEEL site due to its location at the mouth of several mountain valleys. During some years, large numbers of raptors, pronghorn, and sage grouse winter on the INEEL.

1.2.1 Idaho Nuclear Technology and Engineering Center

The INTEC, previously known as the Idaho Chemical Processing Plant (ICPP), is located approximately 12 km (7.5 mi) north of the southern INEEL boundary and covers an area of approximately 80 hectares (200 acres) (Figure 1-2). The primary purpose of this facility was to recover uranium-235 (U-235) from expended military and test-reactor fuel. The INTEC has been in operation since 1954. Facilities at INTEC include spent fuel storage and reprocessing areas, a waste solidification area and related waste storage bins, remote analytical laboratories, and a coal-fired steam-generating plant. The facility originally included a storage pool (housed in a separate building) to store the fuel underwater until a processing campaign was under way. A process building contained dissolvers for the fuel assemblies in nitric and hydrofluoric acids and a solvent extraction system that used tributyl phosphate, hexone, and nitric acid to recover the uranium. After fuel dissolution and extraction, liquid waste was calcined and the resultant granular solids were stored in stainless-steel bins. Laboratory, water-treatment, and evaporator facilities also were a part of the complex, and several types of high-level radioactive liquid waste were produced at the ICPP. In 1992, the reprocessing was phased out, resulting in the current mission, which is to receive and temporarily store spent nuclear fuel and radioactive waste for future disposition.

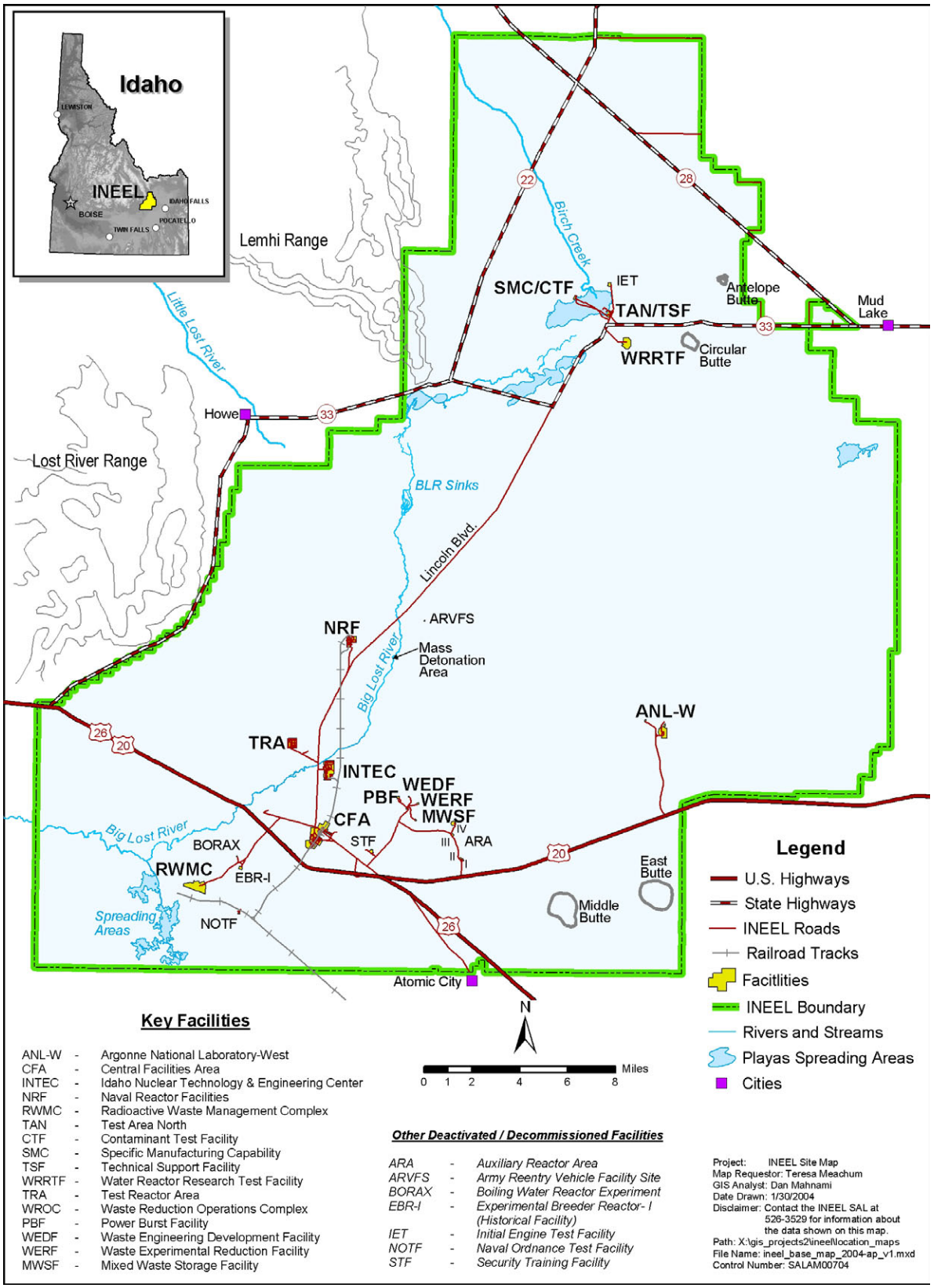

Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory showing the locations of major facilities.

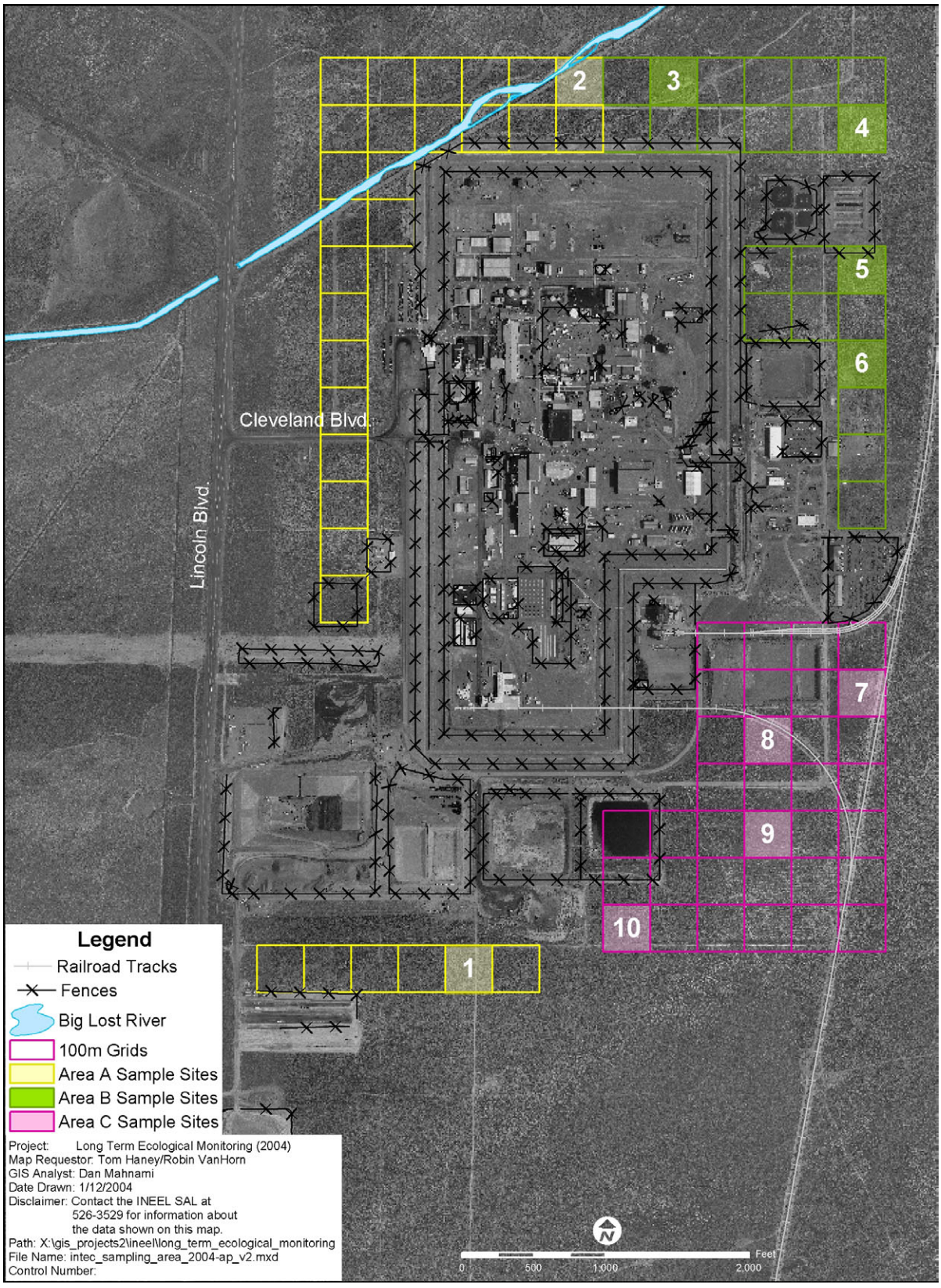

Figure 1-2. Map of the Idaho Nuclear Technology and Engineering Center showing sample grids.

Potential release sites associated with various facilities at INTEC include sumps, ponds, injection wells, spills, and a tank farm used to store hazardous substances. The primary sources of contamination at INTEC include historical waste discharge to the ICPP disposal well, leakage from the concrete holding tanks in the CPP-603 building, and accidental releases to the environment. Potential contaminants include organics, radionuclides, metals, corrosives, petroleum waste, and mixed waste. A detailed discussion of the site-specific ERA and the identified sites of concern is presented in Appendix H3 of the *Comprehensive Remedial Investigation/Feasibility Study for Waste Area Groups 6 and 10 Operable Unit 10-04* (DOE-ID 2001). The grids shown in Figure 1-2 were placed over areas of known or suspected contamination and divided into subareas using professional judgment and historical information about soil contamination and/or distance to source areas. Area A, a lower hazard area than B or C, was slated for two randomly chosen sample plots. Plot 1 was chosen from an area selected to be representative of the INEEL CERCLA Disposal Facility.

1.2.1.1 Environmental Setting—Idaho Nuclear Technology and Engineering Center.

The INTEC is located on the alluvial plain approximately 60 m (200 ft) from the Big Lost River channel near the point where the channel intersects with Lincoln Boulevard on the INEEL. Gravelly, medium- to coarse-textured soils derived from alluvial deposits occur near INTEC. The underlying basalt is covered with as much as 18 m (60 ft) of soil, and the topography is flat. Sagebrush, rabbitbrush, and shrub steppe; sagebrush steppe on lava; and grassland habitat dominate much of the area (Rodriguez et al. 1997). Waterfowl, raptors, rabbits, and bats use the area.

Threatened and/or endangered (T/E) or sensitive species that could exist near INTEC include six terrestrial avian species: the ferruginous hawk (*Buteo regalis*), the peregrine falcon (*Falco peregrinus*), the northern goshawk (*Accipiter gentilis*), the loggerhead shrike (*Lanius ludovicianus*), the burrowing owl (*Athene cunicularia*), the bald eagle (*Haliaeetus leucocephalus*), and three aquatic species: the white-faced ibis (*Plegadis chihi*), the black tern (*Chlidonias niger*), and the trumpeter swan (*Cygnus buccinator*). In addition, three T/E or sensitive mammal species potentially exist near WAG 3; these are the pygmy rabbit (*Brachylagus idahoensis*), Townsend's western big-eared bat (*Plecotus townsendii*), the long-eared myotis (*Myotis evotis*), and the small-footed myotis (*Myotis subulatus*). The sagebrush lizard (*Sceloporus graciosus*) is the only sensitive reptile species with a potential presence. No critical habitat is known to exist in the WAG 3 assessment area.

No formal assessment, with the exception of Cieminski's (1993, 1995) study on wildlife use of wastewater ponds at the INTEC, has been conducted for the presence and use of INTEC facilities by T/E species and by species of special concern. In 1996, this area was surveyed to evaluate suitable habitat for T/E species and by species of concern in areas surrounding INTEC (DOE-ID 2001). In this assessment, a geographic information system analysis was conducted to determine the presence of known T/E or sensitive raptor nesting sites within the vicinity. An analysis showed that nesting by the great horned owl (*Bubo virginianus*) as well as the Swainson's hawk (*Buteo swainsoni*) and the red-tailed hawk (*Buteo jamaicensis*) occurs in the areas surrounding INTEC.

The regularly conducted breeding bird surveys for the area immediately surrounding the INTEC were reviewed (DOE-ID 2001). They indicate that the ferruginous hawk has been recorded only 1 of 6 years on the survey route, and the loggerhead shrike (*Lanius ludovicianus*) has not been recorded any of the 6 years. The burrowing owl (*Athene cunicularia*) has been recorded in the INTEC vicinity. Only one sighting of a sensitive species, the common loon, at the INTEC percolation ponds was recorded during a 3-year study by Cieminski (1993).

The pygmy rabbit is a year-round resident of the INEEL, and because many areas of suitable habitat exist in this area, the species is assumed to be present at INTEC for assessment purposes.

However, based on a preliminary field survey, no areas of suitable habitat or sign of pygmy rabbits were identified near the facility (DOE-ID 2001).

No caves are known to exist in the immediate vicinity of INTEC; the Townsend's western big-eared bat, the long-eared myotis, and the small-footed myotis have not been specifically identified. However, bats are known to frequent the INTEC sewage treatment ponds (Cieminski 1993). As CERCLA sites, the INTEC sewage treatment ponds will be assessed as part of the LTEM Plan (INEEL 2004) within the next 4 years.

A recent field survey report has documented current and previous occurrences of the sagebrush lizard in the INTEC area (DOE-ID 2001). This species is assumed to inhabit areas of suitable habitat in the vicinity.

Migratory birds (e.g., waterfowl and mourning doves) could be present at any facility where water is available. Exposure to and uptake of contaminants by those birds is possible.

Onsite, INTEC does not provide habitat for any of the known T/E or sensitive species. Species of concern for exposure at INTEC include the ferruginous hawk, burrowing owl, pygmy rabbit, and sagebrush lizard for direct and indirect exposure to soil contaminants; and Townsend's western big-eared bat, long-eared myotis, and small-footed myotis for direct and indirect exposure to contaminants in surface water.

1.2.1.2 Contaminants of Potential Concern—Idaho Nuclear Technology and Engineering Center.

Sites at INTEC include various types of pits, a polychlorinated biphenyl transformer yard, an injection well, numerous spills, a percolation pond, a tank farm, a sewage treatment plant, French drains, dry wells, and drainage ditches. Radionuclides and other contaminants from the INTEC processing plants and support systems have been accidentally released to the environment or intentionally released as a result of direct disposal (Rodriguez et al. 1997). Contaminants include organic compounds, radionuclides, heavy metals, corrosives, petroleum waste, and mixed waste. Polychlorinated biphenyls have been documented in soils at several locations, including CPP-49, CPP-51, and CPP-61. Table 1-1 presents the contaminants of potential concern (COPCs) that will be investigated under this 2004 FSP at INTEC. The tables in Appendix A list the analyses to be completed on samples collected at INTEC.

Table 1-1. Contaminants of potential concern summarized from the waste area group ecological risk assessments (long-term ecological monitoring 2004).

COPCs	WAG 1	WAG 2	WAG 3	WAG 4	WAG 5	WAG 8[a]	WAG 9	WAGs 6 and 10
Inorganics	—	—	—	—	—	—	—	—
Arsenic[b]	X	X	—	X	X	X	X	—
Antimony[b]	X	—	—	—	—	—	—	—
Barium	X	X	X	X	—	—	X	—
Cadmium	X	X	X	X	X	—	X	—
Chromium (III)	X	X	X	X	—	—	X	—
Chromium (VI)	—	—	X	—	—	—	X	—
Cobalt	X	—	—	X	X	—	—	—
Copper	X	X	—	X	X	—	X	X
Cyanide[b]	X	—	—	—	—	—	X	—
Lead	X	X	X	X	X	X	X	X

Table 1-1. (continued).

COPCs	WAG 1	WAG 2	WAG 3	WAG 4	WAG 5	WAG 8[a]	WAG 9	WAGs 6 and 10
Manganese	X	—	—	X	X	—	X	—
Mercury	X	X	X	X	X	X	X	—
Nickel	X	—	X	X	X	—	X	—
Selenium	X	X	X	X	X	—	X	—
Silver	X	X	—	X	X	—	X	—
Strontium	—	—	X	—	—	—	—	—
Thallium	X	X	—	—	X	—	—	—
Vanadium	X	—	—	X	X	—	X	—
Zinc	X	X	—	X	X	—	X	X
Organics	—	—	—	—	—	—	—	—
1,3-dinitrobenzene	—	—	—	—	—	—	—	X
2,4-dinitrotoluene	—	—	—	—	—	—	—	X
2,6-dinitrotoluene	—	—	—	—	—	—	—	X
2-amino-4,6-dinitrotoluene[c]	—	—	—	—	—	—	—	X
4-amino-2,6-dinitrotoluene[c]	—	—	—	—	—	—	—	X
RDX	—	—	—	—	—	—	—	X
HMX[c]	—	—	—	—	—	—	—	X
1,3,5-trinitrobenzene[c]	—	—	—	—	—	—	—	X
2,4,6-trinitrotoluene	—	—	—	—	—	—	—	X
4-methyl-4-hydroxy-2-pentanone	—	—	X	—	—	—	—	—
2-methylnaphthalene	X	—	—	—	—	—	—	—
Polychlorinated biphenyls, including aroclors-1248, -1254, and -1260[d]	X[d]	X[d]	X[d]	X[d]	X[d]	—	X[d]	—
TPHs	X	—	—	X	—	—	—	X
Xylene[b]	—	—	—	—	—	—	—	—
Radionuclides[e]	—	—	—	—	—	—	—	—
Am-241, Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Pu-238, Pu-239, Pu-239/240, Sr-90, U-235, U-238, and tritium	NA	NA	NA	NA	NA	—	NA	NA

a. Significant uncertainty exists in the screening-level ecological risk assessment (NRF 1997).
b. Retained due to toxicity and common occurrence as a contaminant at CERCLA sites.
c. No sites with hazard quotient >10 for this contaminant; however, it may be a potential contaminant of concern for postremediation confirmation sampling at ordnance sites.
d. Retained due to environmental persistence and potential for bioaccumulation.
e. Radionuclides were retained for the OU 10-04 and not screened for hazard quotients >10.
COPC = contaminant of potential concern
HMX = high melting point explosive
NA = not applicable
RDX = Royal Demolition Explosive
TPH = total petroleum hydrocarbon
WAG = waste area group

1.2.1.3 Probable Transport Pathways—Idaho Nuclear Technology and Engineering Center.

The INTEC contaminants can potentially affect animals through skin contact, inhalation, ingestion, and external exposure. Potential ecological receptors such as deer mice (*Peromyscus maniculatus*) or cottontail rabbits (*Sylvilagus spp.*) are most likely to contact the contaminants during foraging and burrowing. Animals could ingest soil-adsorbed contaminants during feeding or during preening or grooming. Plants and invertebrates in direct contact with contaminated soil could bioaccumulate contaminants. Animals could then be exposed indirectly by eating plants or animals that have absorbed or adsorbed contaminants from soil. During high winds, animals could inhale and ingest particulates. Ingestion also could occur if animals consume plants or invertebrates that have dust on them. Bioaccumulative contaminants, such as polychlorinated biphenyls, could concentrate in animals and magnify within food chains.

1.2.2 Ordnance Group #2 (Mass Detonation Area)

The MDA has been used for a number of small- to large-scale sympathetic and mass detonation tests. A sympathetic detonation test is a test to find out if a charge explodes when another charge is detonated next to it. During these large mass detonation tests, hundreds of thousands of pounds of explosives in land mines, smokeless powder, and bombs (with test shots ranging up to 500,000 lb of explosives) were placed in explosives storage bunkers or open sites and detonated to determine the effects on collocated bunkers and facilities. Stacks of ammunition were shot with high explosive projectiles to test their susceptibility to enemy fire.

The MDA soils remain contaminated with trinitrotoluene (TNT), Royal Demolition Explosive (RDX), and degradation products. The MDA is still used for destruction of the TNT and RDX fragments and unexploded ordnance from other INEEL ordnance locations. After remediation of all the other ordnance areas is considered complete, the MDA will be investigated to determine if the soil contamination exceeds risk-based levels. Remediation of the locations that exceed risk-based levels will most likely involve removal, treatment, and disposal at an approved facility on or off the INEEL site.

1.2.2.1 Environmental Setting—Mass Detonation Area.

The MDA is located approximately 1.6 km (1 mi) east of Mile Marker 8 on Lincoln Boulevard and approximately 3.2 km (2 mi) east of NRF (see Figure 1-3). The site encompasses approximately 322 hectares (796 acres). The MDA is near the Big Lost River, a stream that flows only during wetter years and infiltrates the ground on the INEEL at the Big Lost River Sinks. The aspect is generally flat with the terrain gradually sloping toward the Big Lost River channel.

Vegetation in the area predominantly consists of sagebrush and crested wheatgrass with lesser amounts of other shrubs, grasses, and forbs. The surrounding areas provide relatively continuous stretches of good sagebrush habitat both on- and off-lava.

The site has nine or more large craters varying in dimensions from a few feet to several tens of feet, a collapsed munitions storage bunker, and structures such as viewing bunkers. The site is also littered with pieces of explosives and structural debris scattered from past testing and recent ordnance detonation or disposal activities or both. The sagebrush-rabbitbrush and salt desert shrubs habitats in the area support a number of species, including sage grouse and pronghorn (important game species). The western meadowlark *(Sturnella neglecta)* and mule deer (a game species) are supported by the grasslands habitat. However, no areas of critical habitat as defined in the *Code of Federal Regulations* (40 CFR Part 300) are known to exist in or around the MDA.

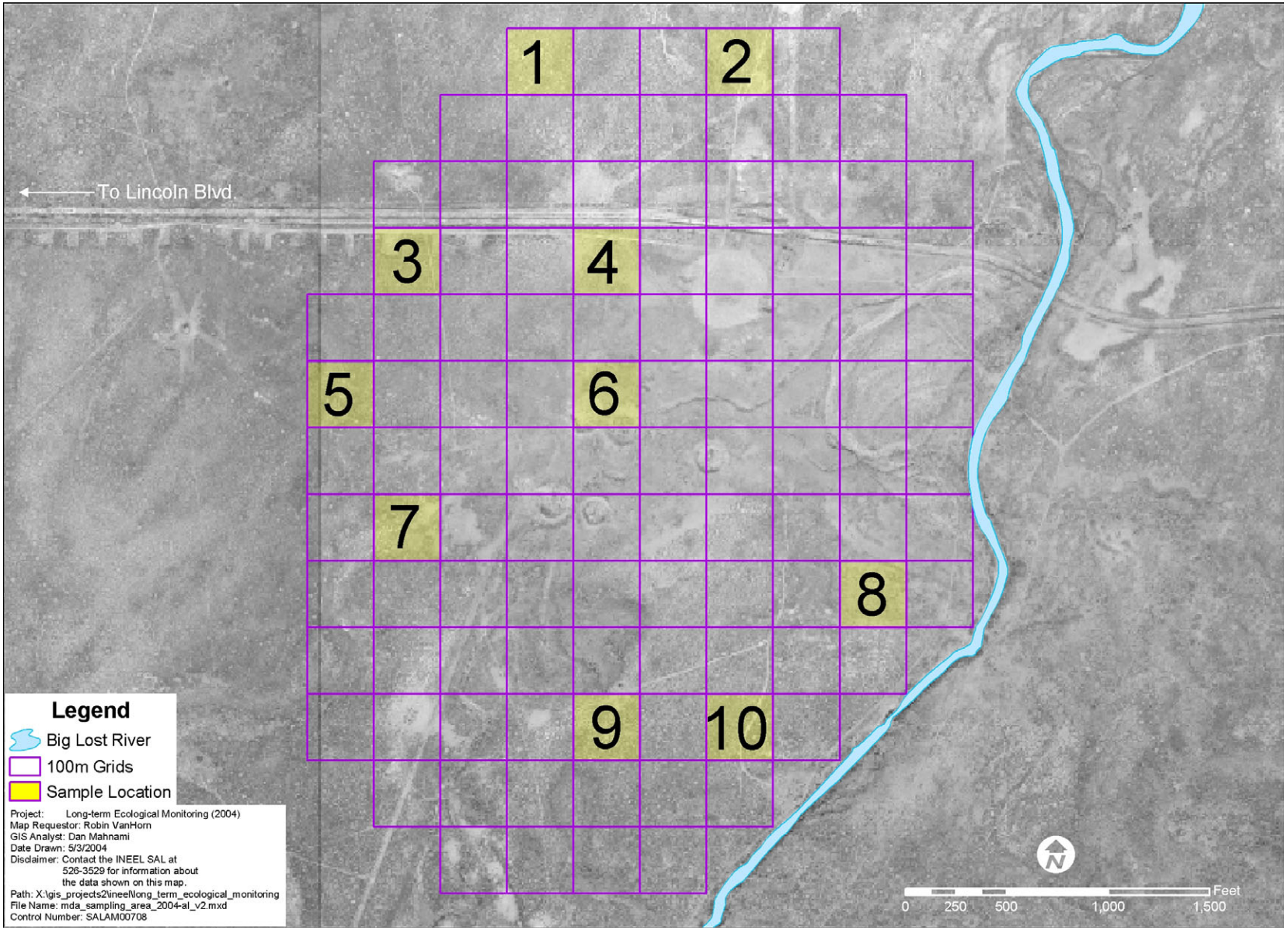

Figure 1-3. Map of Mass Detonation Area showing randomly selected sampling grids.

Six terrestrial avian species that are listed as T/E or sensitive species have the potential for occurrence in the vicinity of MDA. These include the ferruginous hawk (*Buteo regalis*), the peregrine falcon (*Falco peregrinus*), the northern goshawk (*Accipiter gentilis*), the loggerhead shrike (*Lanius ludovicianus*), the burrowing owl (*Athene cunicularia*), and the bald eagle (*Haliaeetus leucocephalus*). Four sensitive mammal species potentially exist in the vicinity, including the pygmy rabbit (*Brachylagus idahoensis*), Townsend's western big-eared bat (*Plecotus townsendii*), long-eared myotis *(Myotis evotis)*, and small-footed myotis (*Myotis subulatus*). The sagebrush lizard (*Sceloporous graciosus*) is the only sensitive reptile species potentially present. Burrowing owls have been sighted in this area in the berms along the road providing access from the west.

The grids shown in Figure 1-3 were placed over areas of known or suspected contamination using professional judgment and historical information. The sampling plots (1 through 10) were chosen by a random number generator.

1.2.2.2 Contaminants of Potential Concern—Mass Detonation Area.

The COPCs for Ordnance Group #2 MDA include TNT, RDX, and several degradation products.

In addition to TNT, RDX, and their associated degradation products, metals are considered COPCs for Ordnance Group #2 MDA. For ecological receptors, the data collected will help determine whether significant adverse effects to plants and wildlife are occurring. See Table 1-2 for the required quantitation limits.

Table 1-2. Analytes, required quantitation levels, and analytical method.

	Requested Quantitation Limit			
Analyte	Soils (mg/kg or pCi/g)	Biota (mg/kg or pCi/g)	Water (µg/L or pCi/L)	Proposed Method
Metals[a, b]				
Antimony	0.06	0.005	1.2	SW-846
Arsenic	0.7	0.03	5.0	SW-846
Barium	20.0	2.0	100.0	SW-846
Cadmium	0.09	0.005	1.0	SW-846
Chromium	0.4	0.15	2.0	SW-846
Cobalt	5.0	0.01	50.0	SW-846
Copper	0.6	2.0	1.0	SW-846
Cyanide	<0.5	N/A	0.005	SW-846
Lead	0.3	0.05	1.0	SW-846
Manganese	1.5	1.5	10.0	SW-846
Mercury	0.01	0.01	0.1	SW-846
Nickel	4.0	0.5	20.0	SW-846
Selenium	0.035	0.01	3.0	SW-846
Silver	0.13	0.005	1.0	SW-846
Strontium	2.0	2.0	0.2	SW-846
Thallium	0.1	0.002	0.4	SW-846
Vanadium	5.0	0.09	40.0	SW-846
Zinc	2.0	2.0	20.0	SW-846

Table 1-2. (continued).

Analyte	Requested Quantitation Limit: Soils (mg/kg or pCi/g)	Requested Quantitation Limit: Biota (mg/kg or pCi/g)	Requested Quantitation Limit: Water (µg/L or pCi/L)	Proposed Method
Explosives[b]				
TNT	0.08	0.08	N/A	SW-846 8330
RDX	0.08	0.08	N/A	SW-846 8330
HMX	0.08	0.08	N/A	SW-846 8330
2,4-dinitrotoluene	0.08	0.08	N/A	SW-846 8330
2,6-dinitrotoluene	0.08	0.08	N/A	SW-846 8330
2-amino-4,6-dinitrotoluene	0.08	0.08	N/A	SW-846 8330
4-amino-2,6-dinitrotoluene	0.08	0.08	N/A	SW-846 8330
Radionuclides[b]				
Gross alpha	10	10	4	Gas proportional counter
Gross beta	10	10	4	Gas proportional counter
Gamma emitters[c]	0.1	0.1	0.1	Gamma Spectrometry
Americium-241	0.05	0.05	0.2	Alpha spectroscopy
Cesium 134, 137	<0.1	<0.1	<30	Gamma spectroscopy
Cobalt-60	<0.1	<0.1	<30	Gamma spectroscopy
Europium 152, 154, 155	<0.1	<0.1	<30	Gamma spectroscopy
Plutonium-238, 239, 239/240	0.05	0.05	0.2	Alpha spectroscopy
Strontium-90	0.5	0.5	1.0	Gas flow proportional counting
Uranium-234, 238	0.05	0.05	0.5	Alpha spectroscopy

Note: Required detection limits for all analytes may be elevated if dilutions are needed due to matrix interferences.
a. High mineral concentrations and matrix complexity could cause dilutions to minimize interelement or matrix interference for metals analysis. Detection limits could be compromised if dilutions are needed.
b. Double volume is needed for laboratory quality control on radiochemistry parameters, and triple volume is needed for metals and explosives (increased volume required for one sample per 20 samples).
c. Limited sample size or low density for matrixes other than soils could cause elevated detection limits for gamma spectrometry.
HMX = high melting explosives.
RDX = cyclotrimethylene trinitroamine.
TNT = trinitrotoluene.

1.2.2.3 Probable Transport Pathways—Mass Detonation Area. Explosives can potentially affect animals through skin contact, inhalation, and ingestion. Ecological receptors such as deer mice or cottontail rabbits are most likely to contact the contaminants during foraging and burrowing. Animals could ingest soil-adsorbed contaminants during feeding or during preening or grooming. Plants and invertebrates in direct contact with contaminated soil could bioaccumulate contaminants. Animals could then be exposed indirectly by eating plants or invertebrates that have absorbed or adsorbed contaminants from soil. During high winds, animals could inhale and ingest particulates. Ingestion also could occur if animals consume plants or invertebrates that have dust on them.

1.2.3 TSF-07 Disposal Pond

The TSF-07 is an unlined disposal pond located southwest of the TSF (see Figure 1-4) at TAN. The TAN facility was built between 1954 and 1961 to support the Aircraft Nuclear Propulsion Program sponsored by the U.S. Air Force and the Atomic Energy Commission. The unlined disposal pond, constructed to replace the TSF-05 injection well, began to receive wastewater in September 1972. The TSF-07 site encompasses a total area of approximately 14 hectares (35 acres), of which 2 hectares (5 acres) in the northeast corner and on the eastern edge is believed to be contaminated with radionuclides and metals (see Figure 1-4). The remaining 12 hectares (30 acres) has never received wastewater and is not contaminated, based on available screening data. The TSF-07 pond is surrounded by a 1.5-m (5-ft) berm. The active portion of the pond consists of a 0.6-hectare (1.5-acre) main pond along the eastern edge. The overflow pond, a 0.4-hectare (1-acre) pond along the northeast edge of the berm, has rarely been used. No radioactivity above background values was detected in a field survey of the western half of the TSF-07 pond performed in 1993. These results are interpreted to indicate that this end of the pond has not been used and that contaminants are not migrating horizontally from the contaminated eastern end of the pond.

The pond received wastewater from a variety of sources, including sanitary waste discharges, low-level radioactive waste, cold process water, and treated sewage effluent originating from TAN service buildings and processes and, more recently, a one-time release of 40,000 gal of treated wastewater from TAN-726. Borated water also was transported from the Loss-of-Fluid Test Facility and poured into a manhole leading into the pond when the Loss-of-Fluid Test Facility was operational. The wastewater was piped to and mixed in a common sump (TAN-655) and subsequently pumped to a concrete inlet basin in the northeast corner of the TSF-07 disposal pond. Wastewater was discharged to TSF-07 via a drainage ditch. The depth of alluvium to basalt in the pond has been estimated to range from 7.5 m (24.5 ft) at the TAN-9 well to 19.5 m (64 ft) at the TSFAG-07 well with an average thickness of 14 m (45 ft).

Currently, the pond is permitted to receive industrial and sanitary waste, but facility personnel indicate that the pond is dry much of the time. If the pond contains water when the field team is present, the pond will be sampled as an aquatic site; sediment, surface water, and aquatic biota samples will be collected. If the pond is dry during the 2004 sampling season, the pond will be sampled as a terrestrial site (i.e., soil, plants, invertebrates, and small mammals).

The fenced disposal pond area is a radiologically controlled soil contamination area. Entry requires radiation worker training and a current radiation work permit specifying, among other things, the required personal protective equipment (PPE) and dosimetry. Samples removed from this area, and any equipment used within the area and subsequently removed, will require a release survey by a radiation control technician (RCT).

Figure 1-4. Map of TSF-07.

1.2.3.1 Environmental Setting—TSF-07 Disposal Pond. The TAN facility is situated in flat playa and lacustrine sediments derived from Birch Creek and the ancient Lake Terreton. Vegetation in the disposal pond area is predominantly green rabbitbrush (*Chrysothamnus viscidiflorus*), crested wheatgrass (*Agropyron cristatum*), and sagebrush (*Artemisia* spp.). There are lesser amounts of other shrubs, grasses, and forbs. Cattail (*Typha latifolia*), bulrush (*Scirpus occidentalis*), and other emergent aquatic plants dominate the wet areas. The area surrounding TAN provides relatively continuous stretches of good habitat. Evidence of small mammal activity was observed along the fence and berm surrounding the disposal pond. Small and large mammal tracks and scat also were observed in the outlying areas. Large mammals such as mule deer (*Odocoileus hemionus*) and pronghorn (*Antilocapra americana*) are occasionally seen using the pond area during the summer. Birds—including yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), northern harrier (*Circus cyaneus),* and western meadowlark *(Sturnella neglecta)*—are commonly observed near the pond area.

Buildings, lawns, and ornamental vegetation and disposal/drainage ponds are utilized by a number of species such as waterfowl, raptors, rabbits, and bats in the TAN area. The sagebrush-rabbitbrush and salt desert shrub habitats in the area support a number of species, including sage grouse and pronghorn (important game species). The western meadowlark *(Sturnella neglecta)* and mule deer (a game species) are supported by the grasslands habitat. However, no areas of critical habitat as defined in the *Code of Federal Regulations* (40 CFR 300) are known to exist at or near TAN.

The use of the TSF-07 disposal pond by wildlife has been documented in *Wildlife Use of Wastewater Ponds at the INEL* (Cieminski 1993). That report contains a complete list of species observed at the disposal ponds and their frequency (Cieminski 1993). TSF-07 is 0.6 hectares (1.5 acres), unlined, and active. It is frequented by waterfowl, including ducks, geese, mergansers, and scaups; shorebirds, including avocets, sandpipers, killdeer, willets, phalaropes, coots, and grebes; swallows; and passerines, including blackbirds, sparrows, starlings, horned larks, and doves; and, to a limited extent, raptors such as kestrels, ferruginous hawks, and northern harriers (Cieminski 1993). The area has minimal fencing, and mammals, including coyotes, muskrats, and pronghorns, have been observed at the disposal ponds (Cieminski 1993). Although no amphibians are known to be present and no surface hydrology exists to support fish, aquatic invertebrates were observed at the pond (Cieminski 1993).

Six terrestrial avian species that are listed as T/E or sensitive species have the potential for occurrence in the TAN vicinity. These include the ferruginous hawk (*Buteo regalis*), the peregrine falcon (*Falco peregrinus*), the northern goshawk (*Accipiter gentilis*), the loggerhead shrike (*Lanius ludovicianus*), the burrowing owl (*Athene cunicularia*), and the bald eagle (*Haliaeetus leucocephalus*). In addition, four aquatic avian species are listed as T/E or sensitive: the white-faced ibis (*Plegadis chihi*), the black tern (*Childonias niger*), the trumpeter swan (*Cygnus buccinator*), and the long-billed curlew (*Numenius americanus*). Four sensitive mammal species potentially exist in the vicinity: the pygmy rabbit (*Brachylagus idahoensis*), the Townsend's western big-eared bat (*Plecotus townsendii*), the long-eared myotis *(Myotis evotis)*, and the small-footed myotis (*Myotis subulatus*). The sagebrush lizard (*Sceloporous graciosus*) is the only sensitive reptile species potentially present.

1.2.3.2 Contaminants of Potential Concern—TSF-07 Disposal Pond. The *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997) discusses the contaminants detected at the TSF-07 disposal pond. Based on the sampling results, an estimated 2 hectares (5 acres) in the eastern and northeastern corner of the pond is known to be contaminated. The highest levels of contamination are found along the drainage ditch from the inlet basin in the northeast corner of TSF-07 to the main pond along the eastern berm (DOE-ID 1997). The main disposal pond is approximately 192 × 30 m (630 × 100 ft) or an area of 5,853 m^2 (63,000 ft^2). The overflow pond is approximately 131 × 24 m (430 × 80 ft) or an area of 3,196 m^2 (34,400 ft^2). The conclusion of the Track 1 report,

Evaluation of Historical and Analytical Data on the TAN TSF-07 Disposal Pond (Medina 1993), is that vertical migration of contamination has occurred, as evidenced by the elevated concentrations of metals in subsurface samples. The elevated radionuclide contamination appears to have occurred from the surface sediments to approximately 3.5 m (11 ft) below ground surface. Infiltration of wastewater at the site likely has increased the mobility of the metals and radionuclide contaminants that are routinely considered immobile (e.g., Cs-137). Organic contamination was assumed to be limited to the top 1.5 m (5 ft) of pond sediment with the exception of isolated acetone and methylene chloride detections at depth. Limited observations of contaminants in the perched water (e.g., Sr-90) also substantiate the sorption of contaminants within the pond sediments and underlying soil. The horizontal extent of contamination is limited to the main and overflow ponds. Contamination outside the TSF-07 has not been detected by field surveys (DOE-ID 1997). For ecological receptors, the data collected will help determine if significant adverse effects to plants and wildlife are occurring. See Table 1-1 for the overall list of COPCs that will be investigated under this FSP for this WAG 1 site.

1.2.3.3 Probable Transport Pathways—TSF-07 Disposal Pond. The disposal pond contaminants can potentially affect animals through skin contact, inhalation, ingestion, and external exposure. Ecological receptors like deer mice or cottontail rabbits are most likely to contact the contaminants during feeding, tracking, and burrowing. Animals could ingest soil-adsorbed contaminants during preening or grooming, drinking contaminated surface water, and eating insects that live in the contaminated soil or water. Some birds, like swallows, use the mud to build nests. During high winds, animals could inhale and ingest particulates. Ingestion also could occur if animals consume plants that have dust or pond water on them. In addition, plants rooting in contaminated soil or water could bioaccumulate contaminants. External exposure can occur from radionuclides in the soil and/or water.

1.2.4 Terrestrial Reference Area

The reference area locations were selected by considering soil type, disturbance, and habitat type. These types of information are critical to interpret the population data. The reference area is outside of the prevailing wind pattern that could introduce site-related contaminants (Figure 1-5). Sagebrush steppe dominates the potentially impacted areas, so the habitat type matches the potentially impacted areas to the greatest extent possible. Figure 1-5 shows the reference area location. The reference area was selected from the proposed region where these three variables most closely match the WAG sites.

1.2.5 Aquatic Reference Area

Mackay Reservoir is the aquatic reference area. It is outside the known plume area and is not within the prevailing wind direction; therefore, this reference area should have negligible impact from the INEEL.

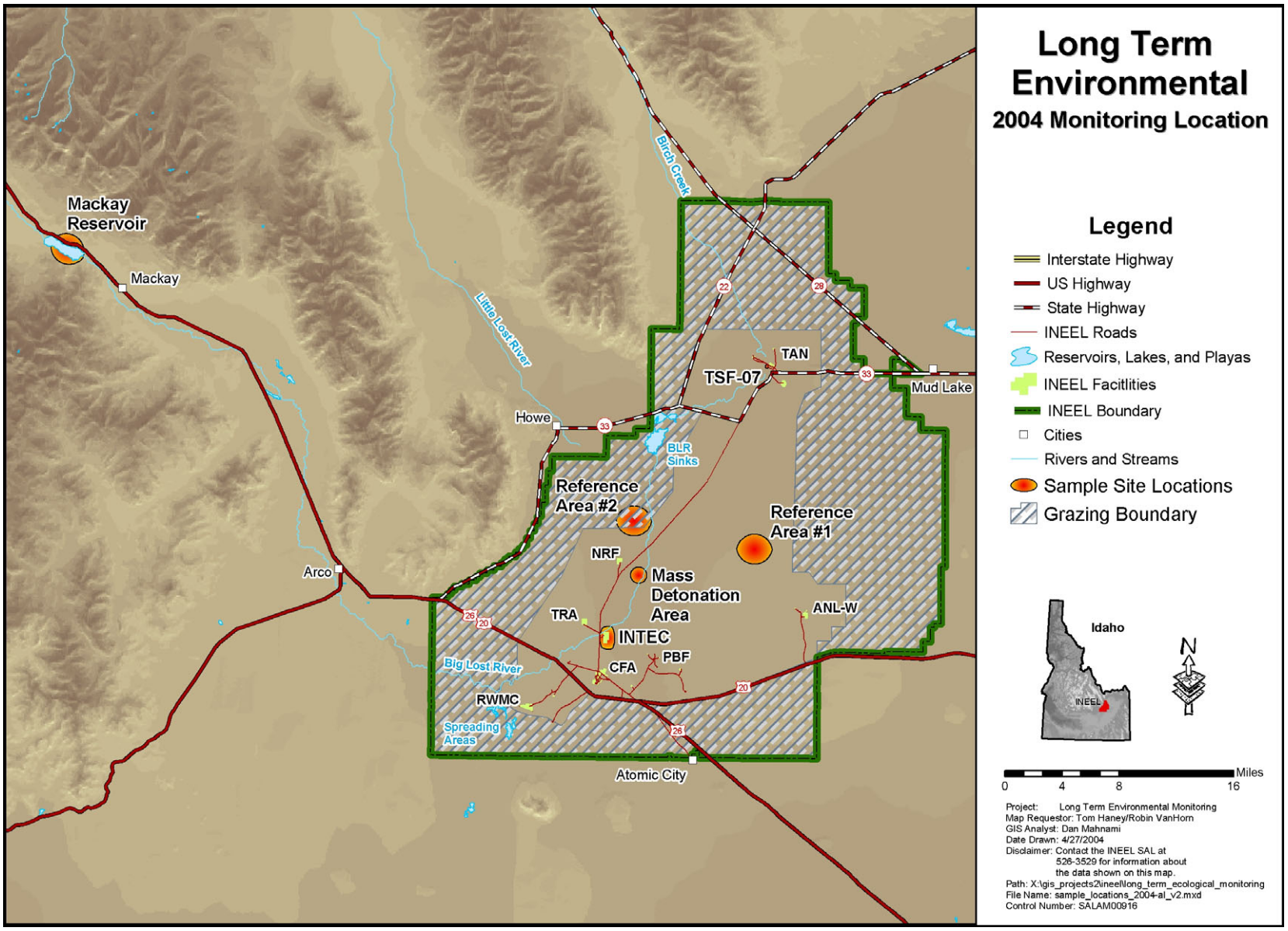

Figure 1-5. Map showing Idaho National Engineering and Environmental Laboratory sample sites and Mackay Reservoir.

1.3 Scope

The LTEM sampling will occur as presented in the LTEM Plan (INEEL 2004). Each year, different locations will be sampled and different activities will take place. Efforts will be directed at sampling for levels of contamination in the selected media and detecting possible effects. To validate the OU 10-04 ERA assumption of no migration of contamination off the areas of concern and to establish a baseline, the levels of contamination in soil, deer mice, and plants will be ascertained. In addition, earthworms from the laboratory bioassay will be evaluated for uptake of contaminants as a cost-effective measure of predicting the role of INEEL invertebrates in the food web transfer of various contaminants. Analytes, required quantitation limits, and analytical methods are shown in Table 1-2. The following activities are part of the 2004 scope:

- Collecting effects data for soil fauna, plants, mammals, and avian receptors at INTEC and Ordnance Group #2. Appendix B and Technical Procedure (TPR) -145, "Biotic and Proximal Soil Sampling," present the sampling procedures used to collect analytical and effects samples at each terrestrial area of concern (AOC) and reference area.

- Collecting effects data for surface water and sediments at TSF-07. Appendix B and TPR-6535, "Collecting Samples Using a Dipper," present the sampling procedures used to collect surface water and sediment analytical samples. Terrestrial effects and analytical samples will be collected according to TPR-145.

- Collecting deer mice for genetic assessment. Deer mice will be collected following the procedures presented in Appendix B and TPR-145. Tails of all deer mice will be collected from those samples for analytical and histopathic evaluation. Additional days of trapping will be used to obtain whole mice solely for genetic work. All genetic samples will be provided to the researcher.

- Collecting soil and vegetation samples (under TPR-145) and preparing the vegetation samples (Guide [GDE] -278, "Preparing Vegetation Samples for the Idaho Completion Project") for gamma comparison.

- Collecting limited opportunistic samples.

- Obtaining necessary prejob paperwork, including safe work permits, scientific collection or trapping permits, and radiological work permits.

- Complying with the requirements of MCP-2725, "Field Work at the INEEL."

- Ensuring that all project personnel are trained.

- Ensuring that sampling equipment, forms, labels, and bottles are available.

- Obtaining vehicle support.

- Obtaining laboratory support.

- Sampling in the spring and early summer of 2004, as described in the Appendix B overview.

2. PROJECT ORGANIZATION AND RESPONSIBILITIES

The following subsections contain descriptions of the personnel associated with this FSP. Table 2-1 contains key personnel assignments and contact information. These responsibilities may change throughout the sampling effort, and a logbook entry will be made to show the name of the individual performing the function.

Table 2-1. Proposed personnel and job assignments.

Assignment	Name	Phone
Technical Lead/Work Package Manager	Robin VanHorn	208-526-1650
Field Team Leaders	Thomas Haney/Robin VanHorn	208-526-9407/208-526-1650
Sample and Analysis Management Program	Theron McGriff	208-526-2275

2.1 Technical Lead/Work Package Manager

The technical lead ensures that all activities conducted during the project comply with INEEL MCPs and program requirement documents as well as all applicable requirements of the Occupational Safety and Health Administration, U.S. Environmental Protection Agency (EPA), DOE, U.S. Department of Transportation, and State of Idaho. The technical lead coordinates all document preparation, field and laboratory activities, data evaluation, risk assessment, dose assessment, and design activities. The work package manager is responsible for the overall work scope, schedule, and budget. The technical lead and work package manager for the LTEM project are the same person. The technical lead is responsible for field activities and for all personnel, including craft personnel, assigned to work at the project location. The technical lead is the interface between operations and project personnel and will work closely with the sampling team at the job site to ensure that the objectives of the project are accomplished in a safe and efficient manner. The technical lead works with all other identified project personnel to accomplish day-to-day operations, identify and obtain additional resources needed at the job site, and interact with environmental, safety, health, and quality assurance (ESH&QA) oversight personnel on matters regarding health and safety.

2.2 Field Team Leader/Job Site Supervisor

The field team leader (FTL) or job site supervisor (JSS) is the INEEL representative at the job site, with responsibility for the safe and successful collection of samples. The FTL/JSS acts as the team leader and works with INEEL facility personnel, ESH&QA personnel, and the field sampling team to manage field sampling operations and to execute the characterization plan. The FTL/JSS enforces site control, documents activities, and may conduct the daily safety briefings at the start of the shift. Health and safety issues may be brought to the FTL's attention.

If the FTL/JSS leaves the job site during sampling operations, an alternate is appointed to act as the FTL/JSS. The identity of the acting FTL/JSS is conveyed to sampling personnel at the sampling location, recorded in the logbook, and communicated to the facility representative (when appropriate).

2.3 Health and Safety Officer

The health and safety officer (HSO) is located at the work site and serves as the primary contact for health and safety issues. The HSO assists the FTL in all aspects of health and safety, including complying with the enhanced work planning process. The HSO is authorized to stop work at the site if any operation threatens workers or public health and safety. The HSO may be assigned other responsibilities, as stated in other sections of the project job safety analysis (JSA), as long as they do not interfere with the primary responsibilities stated here. The HSO is authorized to verify compliance with the JSA, conduct inspections, monitor decontamination procedures, and require and monitor corrective actions, as appropriate. Other ESH&QA personnel at the work site (i.e., safety coordinator, industrial hygienist, RCT, radiological engineer, environmental compliance coordinator, and facility representatives[s]) may support the HSO, as necessary.

The HSO, or alternate, must be qualified (in accordance with the Occupational Safety and Health Act definition [29 USC § 654(a) (1)]) to recognize and evaluate hazards and is given authority to take or direct actions to ensure that workers are protected. While the HSO may also be the industrial hygienist, safety coordinator, or, in some cases, the FTL (depending on the hazards, complexity and size of the activity involved, and required concurrence from the Idaho Completion Project ESH&QA manager) at the work site, other task-site responsibilities must not conflict (philosophically or in terms of significant added volume of work) with the role of the HSO at the work site.

If it is necessary for the HSO to leave the work site, then the HSO will appoint an alternate to fulfill this role. The identity of the acting HSO will be recorded in the FTL logbook, and work-site personnel will be notified.

2.4 Samplers

Samplers include all task site personnel assigned to the characterization project to obtain samples for analytical purposes. All samplers (including INEEL, DOE, and subcontractor personnel) must understand and comply with the requirements of this document and other applicable documentation. The FTL/JSS will brief the sampling personnel at the start of each shift regarding the tasks to be performed and the applicable health and safety requirements. Work tasks, associated hazards, engineering and administrative controls, required PPE, work control documents, and radiological and emergency conditions are discussed during the prejob briefing.

Samplers are responsible for identifying any potentially unsafe situation or condition to the FTL/JSS and applicable ESH&QA representatives for corrective action. If it is perceived that an unsafe condition poses imminent danger, sampling personnel are authorized to stop work immediately and notify the FTL/JSS of the unsafe condition.

2.5 Waste Generator Services Waste Technical Specialist

The INEEL Waste Generator Services (WGS) waste technical specialist ensures that the disposition of waste material complies with approved INEEL waste management procedures. The WGS personnel have the responsibility to help solve waste management issues at the task site. In addition, WGS personnel prepare the appropriate documentation for waste disposal and make the proper notifications, as required. All waste is disposed of using approved INEEL procedures in accordance with INEEL Program Requirements Document (PRD) -5030, “Environmental Requirements for Facilities, Processes, Materials and Equipment.”

2.6 Sample and Analysis Management Program

The Sample and Analysis Management (SAM) Program is responsible for helping to define the analytical project, generating the sampling and analysis plan table, and generating and issuing sample labels. The SAM Program determines the laboratory that will provide analytical services based on established policies and contracts and prepares the task order statement of work. The SAM Program also tracks analytical progress and performs a cursory review of the final data packages. The SAM representative obtains validation of the data results as project requirements dictate.

2.7 Environmental, Safety, Health, and Quality Assurance Support

The ESH&QA personnel are assigned to the job site to provide resources and expertise to resolve ESH&QA issues. Personnel assigned to provide ESH&QA support must be qualified to recognize and evaluate hazards, environmental concerns, or quality issues according to his or her expertise and are given the authority to take or direct immediate actions to ensure compliance and protection. In addition, ESH&QA personnel assess and ensure compliance with applicable INEEL procedures, including this document.

Radiological control support personnel are the source for information and guidance on radiological hazards at the job site. Radiological support personnel may include the radiological control supervisor, RCTs, and radiological engineers. The RCT is responsible for surveying the task site, equipment, and samples and for providing guidance on work activities in accordance with PRD-183, "INEEL Radiological Control Manual." The radiological engineer provides information and guidance relative to the evaluation and control of radioactive hazards at the job site, including performing radiation exposure estimates and as low as reasonably achievable evaluations, identifying the type(s) of radiological monitoring equipment necessary for the work, and advising personnel of changes in monitoring and PPE.

2.8 Data Storage Administrator

The data storage administrator is responsible for the maintenance of data records. All data will be maintained in accordance with Plan (PLN) -1401, "Transferring Integrated Environmental Data Management System Data to the Environmental Data Warehouse."

3. DATA QUALITY OBJECTIVES

The EPA developed the data quality objective (DQO) process to ensure that the type, quantity, and quality of data used in decision-making are appropriate for the intended application. The DQOs presented in this FSP are consistent with, but are not identical to, those presented in the LTEM Plan (INEEL 2004). These DQOs correspond to the field sampling activities planned for 2004, whereas the LTEM Plan has a broader, long-term focus. The DQOs for Fiscal Year (FY) 2004 are summarized in Table 3-1.

Table 3-1. Data quality objectives.

Problem Statement	The objective of sampling at each AOC identified in the LTEM Plan (INEEL 2004) is to evaluate the present level of contamination at each AOC and identify potential effects to ecological receptors that occur at each AOC, as compared to the reference areas.
Decision Statement	**DS-1:** Determine whether the levels of site-related contaminants, in either biotic or abiotic media, are elevated relative to the reference areas and whether ecological effects occur. **AA-1:** Site-related contaminants are elevated and effects are evident relative to the reference areas. Evaluate whether any correlation or association exists between contaminants and effects to determine the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2004). **AA-2:** Site-related contaminants are elevated, but no effects are apparent relative to the reference areas. Evaluate the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2004), to detect effects based on those contaminants identified as elevated. **AA-3:** Site-related contaminants are not elevated, but effects are evident relative to the reference areas. Evaluate if additional contaminants are present to identify more sampling requirements. **AA-4:** Site-related contaminants are not elevated, and no effects are evident relative to the reference areas. Continue monitoring at an appropriate level for trending, for ensuring the remedy remains ecologically protective, and for supporting 5-year reviews.
Inputs to the Decision	Characterization of contaminant concentrations: • Contaminant concentrations in soils collocated with vegetation • Contaminant concentrations in crested wheatgrass and sagebrush • Contaminant concentrations in deer mice collocated with soil and vegetation samples • Contaminant concentrations in receptors collocated with sediment and surface water samples. Characterization of effects: • Vegetation community structure, plant bioassay • Invertebrate community structure, invertebrate bioassay • Mammal community structure, organ and body weights, histopathology, genetic analysis • Avian community structure • Avian egg count, hatching success, fledgling count, fledgling body weight • Soil, physical and nutrient characteristics.
Study Area Boundary	Areas to be sampled during FY 2004 include INTEC, the TSF-07 disposal pond, Ordnance Group #2, and one aquatic and two terrestrial reference areas. A 100- × 100-m (110- × 110-yd) grid consisting of 100-m^2 (120-yd^2) cells will be placed over the areas of known or suspected contamination. A similar grid will be placed over the reference area. Ten cells will be randomly selected from within the reference area. To ensure optimal distribution of cell allotments, subareas will be delineated in the areas of highest known contamination. Using a stratified random sampling approach, 10 cells (i.e., plots) will be selected from this grid based upon apportioning samples to the subareas by subarea areal extent. Sampling will be conducted in each plot so that samples are temporally and spatially collocated. Soil, plant, and small mammal samples will be collected from all locations.

Table 3-1. (continued).

Decision Rules	If analyte concentrations in any media exceed those at the reference areas ($p < 0.05$ or other appropriate background evaluation), then determine if a correlation exists between contaminants and effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2004). If site-related contaminants are significantly elevated compared to the reference area, but no effects are apparent relative to the reference areas based on an evaluation of the data, then evaluate the need for additional associated studies, as discussed in the LTEM Plan, to detect effects based on those contaminants identified as elevated. If site-related contaminants are not significantly elevated compared to the reference area, but effects are evident relative to the reference areas based on an evaluation of the data, then evaluate whether additional contaminants are present to identify additional sampling requirements. No further sampling will be performed if effects are related to physical disturbance, such as soil compaction or removal of topsoil. If site-related contaminants are not significantly elevated and no effects are evident relative to the reference areas based on an evaluation of the data, then further sampling (for monitoring or otherwise) will not be performed.
Specify Tolerable Limits on Decision Errors	Analyte concentrations can range from below detection limits to well above reference area concentrations. The study design is based on professional judgment, and preset limits on the decision error are not applicable, because the sample size is fixed at 10 random locations. Statistics will be applied and trends will be evaluated. Error analysis will be carried out when feasible. The data are being collected for long-term needs that cannot be quantified at this point. The limits on decision errors are used to determine sample size, which in this case was based on expert knowledge to maximize resources.
Optimize the Sampling Design	The sampling design has been optimized to focus on the areas most likely to be impacted by sources of contamination. Environmental concentrations are likely to be higher near the facilities. If elevated concentrations in various media are not found close to the facility, it is unlikely they would be found farther away.

AA = alternative action
AOC = area of concern
DS = decision statement
FY = fiscal year
INEEL = Idaho National Engineering and Environmental Laboratory
INTEC = Idaho Nuclear Technology and Engineering Center
LTEM = long-term ecological monitoring
TSF = Technical Support Facility

The DQO process includes seven steps, each having specific outputs. Each of the following subsections corresponds to a step in the DQO process, and the output for each step is provided as appropriate. The outputs of the DQO process can be used to develop a statistical sampling design and to effectively plan field investigations that can stand up to rigorous review. The DQOs specific to laboratory precision and accuracy are presented in the QAPjP (DOE-ID 2002b).

3.1 Step 1—State the Problem

The first step in the DQO process is to clearly state the problem. As discussed in the LTEM Plan (INEEL 2004), the problem is that residual contamination will remain after remediation at the INEEL under CERCLA. LTEM will be implemented at the INEEL to verify that the objectives of each INEEL remedial action are maintained for ecological receptors and to determine whether the long-term sitewide ecological impact of the contamination left in place is within acceptable limits. The overall project objective of LTEM is to develop an integrated approach to ensure continued protection of INEEL ecological resources from CERCLA-related contaminants; the objective of this FSP is to collect sufficient data to meet the objectives of the LTEM Plan.

The FSP-specific DQOs apply to the data collection activities at each AOC being sampled under the LTEM Plan (INEEL 2004). The objective of this sampling activity is to ascertain whether contaminant concentrations in each AOC are elevated in comparison with reference areas and to whether effects to ecological receptors from these higher concentrations are evident. If the results of this sampling activity show both elevated concentrations and effects, then more studies may focus on detecting additional effects, possible biomarkers, and indicators, as discussed in the LTEM Plan. The data collected within the scope of this FSP in 2004 at INTEC, TAN TSF-07, Ordnance Group #2, and the reference areas will become part of a database of information collected from various sites for many years. The results of the 2004 sampling activity also will be used to direct associated studies focused on the detection of effects and possible biomarkers and indicators, as discussed in the LTEM Plan.

Several secondary objectives may be met by the FY 2004 sampling design, including the identification of trends in contaminant migration from the AOCs.

3.2 Step 2—Identify the Decision

Identifying the decision is primarily a matter of stating what will be done. The decision statement (DS) pertinent to the 2004 FSP is presented below.

3.2.1 Decision Statement

Determine whether site-related contaminant concentrations, in either biotic or abiotic media, are elevated relative to the reference areas and whether effects to ecological receptors occur.

3.2.2 Alternative Actions

Four possible alternative actions (AAs) could stem from the outcome of the DS for FY 2004 sampling.

AA-1: Site-related contaminants are elevated and effects are evident relative to the reference areas. Evaluate whether any correlation or association exists between contaminants and effects to determine the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2004).

As sampling progresses, indicators of bioaccumulation through the food web might necessitate sampling of higher trophic-level organisms to verify contaminant movement through the food web and to evaluate possible effects to these organisms. Higher trophic-level species include species such as a badger and coyote. This type of information would be collected to support the larger objectives identified in the LTEM Plan (INEEL 2004).

AA-2: Site-related contaminants are elevated, but no effects are apparent relative to the reference areas. Evaluate the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2004), to detect effects based on those contaminants identified as elevated.

Sampling for effects may be very contaminant specific. If no effects are indicated using the approach documented in this FSP, then more focused sampling (i.e., associated studies) may be needed.

AA-3: Site-related contaminants are not elevated, but effects are evident relative to the reference areas. Evaluate if additional contaminants are present to identify more sampling requirements. No further sampling will be performed if effects are related to physical disturbance, such as soil compaction or removal of topsoil, as determined by visual observation.

AA-4: Site-related contaminants are not elevated, and no effects are evident relative to the reference areas. Continue monitoring at an appropriate level for trending, for ensuring the remedy remains ecologically protective, and for supporting 5-year reviews. These data will go forward to be assessed with the other sites during the multiyear sampling effort.

3.3 Step 3—Input to the Decision

The objective of DQO Step 3 is to identify the information that will be required to determine the appropriate AA identified in DQO Step 2. The information needed to resolve the DS listed above is the identification and quantification (minimum, maximum, and average concentrations) of contaminants present in each of the sampling areas or subgroups and the various endpoints' effects. The data types to be collected include COPC concentrations in soil, selected vegetation species, small mammals, and an aquatic species as available (e.g., tadpoles). In addition, species identification and counts will be recorded for all vegetation collected. These data also document the number of small mammals trapped and released or sacrificed. Specific inputs may include, but are not limited to, the following:

- Soil cation exchange capacity, pH, and total organic carbon
- Contaminant concentrations in soils collocated with vegetation
- Contaminant concentrations in crested wheatgrass and sagebrush
- Contaminant concentrations in deer mice collocated with soil and vegetation samples
- Vegetation community structure and plant bioassay
- Invertebrate community structure and invertebrate bioassay
- Mammal community structure, organ and body weights, histopathology, and genetic analysis
- Avian community structure
- Egg counts, hatching success (number hatched per number of eggs), number of birds fledged, and fledgling weight (if bird nests are present during the spring of 2004)
- Contaminant concentrations in surface water, sediments, and (if present) tadpoles or frogs in the TSF-07 disposal pond
- Contaminant analysis and histopathology of a selected aquatic receptor from TSF-07.

See Appendix B and the LTEM Plan (INEEL 2004) for more specific discussion of these inputs.

3.4 Step 4—Study Area Boundary

The primary objective of this step is to define the scale of decision-making, clearly describing the "what, when, and where" data will be collected during FY 2004 sampling activities. These data include the populations of interest as well as spatial and geographical boundaries.

3.4.1 Populations of Interest

Three AOCs and three reference locations will be evaluated in 2004 under this FSP. At these AOCs, the sampling area will be reduced to those with known or suspected contamination. Sampling within these areas of known contamination is designed to optimize the ability to detect contamination and

effects. It is acceptable to limit the sampling in this manner, because if no effects are observed near the contaminant source, it is unlikely that effects would be observed at distances farther from the source(s) or in areas of lower contamination.

To determine if possible elevated levels of contamination or effects exist in these AOCs, both biotic and abiotic media were selected as indicators. The media selected for sampling should be good indicators and should be reasonably easy to collect. As stated in the LTEM Plan (INEEL 2004) and in this FSP, additional media and species of concern will be selected for collection as data collection proceeds in the coming years. Media selected for annual terrestrial sampling at each AOC are discussed below.

3.4.1.1 Flora and Fauna. As discussed in the LTEM Plan (INEEL 2004), the considerations for selecting organisms to be evaluated for monitoring and assessment are (a) abundance in the area of concern (because highly abundant species are more likely to be an important part of the food web), (b) occurrence within the impacted areas (because this will make them available for sampling), and (c) life history (highly exposed species are likely to be more affected than unexposed species). The rationale for each of the selected sampling efforts is discussed below. However, based on the outcome of future sampling, additional species might be identified and evaluated.

3.4.1.1.1 Animals—Initially, one terrestrial animal species, representing major linkages between primary and secondary consumers and higher predators, will be collected for tissue analyses. The animal selected as the most appropriate for sampling in the 2004 FSP was the deer mouse (Peromyscus maniculatus). The deer mouse is a major prey item for both secondary and tertiary consumers and is omnivorous, widespread, and relatively easy to collect. This species will be used to represent several important linkages in the food chain.

Additionally, the soil faunal community will be evaluated under the 2004 FSP. Soil fauna (including nematodes, Collembola, and mites) are useful bioindicators for environmental monitoring programs because of their role in essential ecological functions of soil, including nutrient cycling and decomposition. Microinvertebrates play multiple roles in regulating decomposition through grazing, fragmentation of debris, and excretion. In addition, decomposition rates can serve as indicators in detecting toxic effects on ecosystem processes. Soil fauna have relatively limited movements, thus spatially associating them with environmental contaminant levels.

A representative aquatic species for chemical analysis will be selected if present at the disposal pond. Various amphibian species are known to have home ranges that overlap the INEEL. Tadpoles or frogs, if present, would be expected to be maximally exposed by continuous contact with sediment and surface water. Tadpoles or frogs also would be expected to form an important part of the food web.

This year, the project will evaluate the use of opportunistic capture as well as drift fences, pitfall traps, and funnel traps to determine the best methods of catching reptiles and/or amphibians on the INEEL. This information will be used for collection and to evaluate the presence and variety of reptiles and amphibians at the sampling areas. The approaches evaluated and the results will be documented in the FTL logbook.

In addition, the avian community will be evaluated this year to assess the feasibility of nest searches as a means of monitoring land birds in each of the study areas. Each area will be walked down, and the location of nests, the species that built the nests, and the number of eggs found in each nest will be recorded. The viability of collecting eggs from each study area and testing them for contaminants will also be addressed. The number of nests and the species that built them will determine how many eggs from which species are most appropriate for collection.

Avian point counts will also be used to assess species occurrence and relative abundance in each study area. Point counts have been used throughout North America for long-term bird monitoring programs such as the Breeding Bird Survey. The center of each of the 10 plots per study area will represent the location of one 3-minute, 50-m (55-yd), limited-radius point count. All individuals of all species seen or heard during the observation period will be counted. This procedure is based on methods used during the Breeding Bird Survey and by Stoller Corporation (www.stoller-eser.com) at the INEEL. The radius has been decreased to prevent point overlap.

3.4.1.1.2 Plants—Plants represent a major linkage in the transfer of soil-borne contaminants to primary consumers and higher trophic levels. Plant foliage also may be effective at removing contaminants from the air. Two types of vegetation representing different growth forms (i.e., shrubs, grasses, and forbs) will be collected for chemical analysis. These species are as follows:

- Sagebrush (*Artemisia tridentata*)
- Crested wheatgrass (*Agropyron cristatum*)
- Hardstem bulrush (*Scirpus acutus*).

Sagebrush represents the shrub most commonly used by INEEL primary consumers, including the pronghorn, sage grouse, black-tailed jackrabbit, Nuttall's cottontail rabbit, and pygmy rabbit. In addition, sagebrush is an important component in the diets of avian and mammalian omnivores and herbivorous insects. Most of the natural vegetation at the INEEL consists of a shrub overstory with an understory of perennial grasses and forbs. The most common shrub present at the site is the Wyoming big sagebrush (*Artemisia tridentata* subspecies *wyomingensis*). However, basin big sagebrush (*Artemisia tridentata* subspecies *tridentata*) is sometimes dominant or co-dominant with Wyoming big sagebrush on sites having deep soils or accumulations of sand on the surface (Shumar and Anderson 1986). It is difficult to distinguish these two species, and it is assumed that uptake by both of these subspecies is similar.

Wheatgrasses (*Agropyron* spp.) are most widely used in monitoring programs and are significant components in the diets of jackrabbits, cottontail rabbits, birds, and small mammals. Crested wheatgrass (*Agropyron cristatum)* is the most commonly identified genus in the dietary studies examined, with cheat grass (*Bromus tectorum*) being the second most common. Although crested wheatgrass is an introduced species at the site, it is the most commonly occurring species.

Hardstem bulrush (*Scirpus acutus*) is found in outflows and lagoons near facilities. It is a persistent emergent that can be found in deep and shallow marshes, generally in water depths to 1.5 m (5 ft), but can be found much deeper. It prefers sandy to marly substrates that provide good water circulation in the root zone. Hardstem bulrush can form colonial stands or be intermixed with other emergents. It also has a higher tolerance of mixosaline conditions than the related softstem bulrush (*S. validus*). Waterfowl and shorebirds eat the nutlets, which are an important and frequently used food. Muskrats and geese eat the rhizomes and stems. Bulrushes (*Scirpus* spp.) also provide important nesting habitat and cover for a wide variety of birds and furbearers (Gleason and Cronquist 1991; Voss 1972).

3.4.1.2 Abiotic Media

3.4.1.2.1 Soil—Soil samples will be collected from the surface and subsurface. The surface soil samples will be collected from 0 to 5 cm (0 to 2 in.), and the subsurface will be collected from 5 to 61 cm (2 to 24 in.) or bedrock. The depth of each individual soil sample must be recorded along with the diameter of the soil core. This information is necessary to determine the concentration of the contaminant per unit area of land surface. The soil samples will consist of composites from locations

within the sampling plots that correspond to plants from which vegetation samples are collected. It is anticipated that this drop will concentrate on sampling and analytical efforts on the depth most likely to pose a source of contamination to plant roots and ingestion/physical exposures for surface-dwelling and burrowing animals. Historical data collected at the INEEL include sampling depths of approximately 5, 10, and 15 cm (2, 4, and 6 in.) and additional data for soil depths up to 3.1 m (10 ft). Soil nutrients and physical characteristics also will be evaluated.

3.4.1.2.2 Sediment—Sediment samples will be collected from within the top 15-cm (6-in.) depth using a spoon, scoop, auger, or other tools. The samples will consist of grab samples from locations along the pond boundary. A total of five sediment samples will be collected from the disposal pond and five from the aquatic reference area. If the disposal pond is dry, soil samples will be collected in lieu of sediment samples.

3.4.1.2.3 Surface Water—A total of five surface water samples will be collected from the disposal pond and five from the aquatic reference area. Surface water samples will be collected by taking a grab sample before collecting the sediment sample. Surface water and sediment samples will be collected from the same locations. If the pond is dry, surface water samples will not be collected and the area will be evaluated from a terrestrial perspective.

3.4.2 Spatial Boundaries

The sampling areas for FY 2004 include INTEC, the TSF-07 disposal pond, Ordnance Area #2, and one aquatic and two terrestrial reference areas. The grids for plot selection were placed over the areas of known or suspected contamination identified from site knowledge at each area. The grids will be divided into potentially impacted subareas using professional judgment based on historical information concerning radiological or chemical concentrations in soil or distance to the source area.

The terrestrial reference areas were selected by considering soil type, disturbance, and habitat type. These types of information are critical to interpret population data. The reference areas are outside the facilities' prevailing wind pattern that could introduce site-related contaminants (Figure 1-5). The habitat type at the reference matches the potentially impacted areas to the greatest extent possible. A boundary was placed around the reference area such that it covered approximately the same areal extent as the study areas (each reference area is approximately 73 hectares [180 acres]). The numbers of samples (10) matches that of the potentially impacted study areas.

3.5 Step 5—Develop a Decision Rule

Decision rules are if/then statements that describe the actions that will be taken in response to the results of data collection. The DS identified in Step 2 of the DQO process has associated decision rules.

The DS in Step 2 requires determination of whether site-related contaminant concentrations (in either biotic or abiotic media) are elevated relative to the reference areas and whether effects are apparent. Various data will be collected in the reference areas and compared with data obtained from AOCs. These data include population/community indicators (e.g., density and biomass), histopathology, and toxicity bioassay data as well as concentrations of contaminants in various media. Accepted comparisons based on data collected will be used for statistical assessment. For example, appropriate statistical tests will be used to compare the AOC with the reference area(s). As discussed in Subsection 3.2.2, four possible alternatives could stem from the outcome of the FY 2004 sampling.

If site-related contaminants are elevated and effects are evident relative to the reference areas, then the data will be evaluated to detect any correlation or association existing between contaminants and

effects to determine the need for additional associated studies as discussed in the LTEM Plan (INEEL 2004).

If site-related contaminants are elevated, but no effects are apparent relative to the reference areas, then the need for additional associated studies, as discussed in the LTEM Plan (INEEL 2004), will be evaluated to detect effects based on those contaminants identified as elevated.

If site-related contaminants are not elevated, but differences are apparent between the AOCs and the reference areas, then an evaluation will be done to determine whether additional contaminants are present and necessitate additional sampling requirements.

If site-related contaminants are not elevated and no differences are evident between the AOCs and the reference areas, then further sampling (for monitoring or otherwise) will not be performed unless indicated by the LTEM Plan assessment.

3.6 Step 6—Specify Tolerable Limits on Decision Errors

There are two null hypotheses (H_0): one for the analytical data types and one for the effects data types. The data collected under LTEM will have components that contain both statistical and nonstatistical design aspects.

In general, the H_o for each of the analytical data types states that concentrations in biotic or abiotic media exceed the reference area concentrations by at least a specific amount. The alternative hypothesis (H_a) states that they do not exceed the reference area concentrations. A similar approach will be used for the effects data types; however, an indication of an effect may be indicated by either a lower or a higher value than the reference area.

False acceptance of either H_0 would result in a moderate consequence of possible wasted cost and the effort of additional data collection and evaluation. There is a low likelihood of a more severe consequence involving reevaluation of the ROD (DOE-ID 2002a) and site remediation. False rejection of either H_0 would result in excess potential for adverse effects to ecological receptors. The consequences of a false rejection may range from low to severe, and the actual consequences are difficult to predict. Based on previous evaluations, most effects are expected to be localized.

3.7 Step 7—Optimize the Sampling Design

The purpose of this step in the DQO process is to identify a resource-effective design for generating data to support decisions.

3.7.1 Sampling Locations

Sampling will be performed at each terrestrial AOC using a stratified random approach. This will be implemented by placing a 100- × 100-m (110- × 110-yd) grid consisting of 100-m^2 (120-yd^2) cells over the areas of known or suspected contamination (i.e., the exposure area) identified from historical site knowledge. The exposure area grid will be divided into potentially impacted subareas using professional judgment based on historical information concerning radiological or chemical concentrations in soil or distance to the source area. Samples will be located randomly but allocated to each of the recognized potentially impacted subareas in the exposure area. The number of samples in a subarea will be proportional to the dimension of the area, unless some known reason to do otherwise exists. Thus, smaller subareas will have fewer samples than larger subareas.

A field reconnaissance will be used to assess the species presence and abundance within each randomly selected 100- × 100-m (110- × 110-yd) grid. Based on professional judgment, the nearest appropriate grid cell will be selected if the grid cell is too disturbed, if target species are not present, or if other experiments and activities may be disturbed.

The grid cell size will represent a plot that is considered large enough to incorporate changes and natural variability observed in patchy habitats, yet small enough to correlate soil concentrations with biota concentrations or physiological effects. A larger cell size could dilute the relationship between soil concentration and effects, whereas a smaller cell size could be subject to more variability in community parameters.

At the aquatic locations, sampling will be focused on the riparian area or within 10 m (11 yd) of open water. A 6- × 6-m (6.5- × 6.5-yd) grid will be established in the riparian zone around the disposal pond and the aquatic reference area. Sampling of sediment and surface water will occur in five randomly selected 5-m^2 (6-yd^2) grid cells. An aquatic receptor will be collected from within the disposal pond and reference area as close to the sampled grid cells as feasibly possible.

4. SAMPLE COLLECTION, ANALYSIS, AND DATA MANAGEMENT

4.1 Sample Collection

4.1.1 Presampling Meeting

Before sampling takes place, project personnel will meet to ensure that sampling and analysis can be performed in a safe manner and will provide the project with usable data. Project personnel also ensure that all necessary equipment and documentation are present and all personnel understand the project scope and objectives.

4.1.2 Sampling and Analysis Requirements

Tables 4-1 through 4-5 provide general summaries of the areas to be sampled, analytes, sample depths and types, and the number of samples for the major analyses. Appendix A includes the sampling and analysis plan tables and the field guidance forms that together include all of the sample descriptions, locations, analysis types, quantities, containers, holding times, and preservative requirements that apply to samples being collected under this FSP.

Table 4-1. Biased composite biotic and collocated soil samples at the Idaho Nuclear Technology and Engineering Center.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Selected metals	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10
Selected radionuclides	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10

Note: No duplicates for biota will be collected. The laboratory will prepare matrix duplicates from the appropriate digestates.
a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.

Table 4-2. Biased composite biotic and collocated soil samples at the TSF-07 disposal pond.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
		Dry Areas of Pond		
Selected metals	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	2
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	2
	NA	Deer mice	Composite of 5 to 10 animals/plot	2
	NA	Sagebrush	Composite of greater than 5 plants/plot	2
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	2
Selected radionuclides	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	2
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	2
	NA	Deer mice	Composite of 3 to 10 animals/plot	2
	NA	Sagebrush	Composite of greater than 5 plants/plot	2
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	2
		Aquatic Areas		
Selected metals	0 to 15 cm (0 to 6 in.)	Sediment	Grab sample from randomly located grid cell	5
	NA	Surface water	Grab sample from randomly located grid cell	5
	NA	Aquatic receptor	Composite of multiple animals/plot to attain 60 g	5
	NA	Aquatic plant	Composite of 5 plants	5
Selected radionuclides	0 to 15 cm (0 to 6 in.)	Sediment	Grab sample from randomly located grid cell	5
	NA	Surface water	Grab sample from randomly located grid cell	5
	NA	Aquatic receptor	Composite of multiple animals/plot to attain 60 g	5
	NA	Aquatic plant	Composite of 5 plants	5

Note: No duplicates for biota will be collected. The laboratory will prepare matrix duplicates from the appropriate digestates.
a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.

Table 4-3. Biased composite biotic and collocated soil samples at Ordnance Area #2.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Selected metals	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10
Nitroaromatics	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 borings/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10

Note: No duplicates for biota will be collected. The laboratory will prepare matrix duplicates from the appropriate digestates.
a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.

Table 4-4. Biased composite biotic and collocated samples for contaminant analysis at the terrestrial reference area.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Selected metals	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 cores/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 cores/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10
Selected radionuclides	0 to 5 cm (0 to 2 in.)	Soil	Surface composite—up to 5 borings/plot	10
	5 to 61 cm (2 to 24 in.)	Soil	Subsurface composite—up to 5 borings/plot	10
	NA	Deer mice	Composite of 5 to 10 animals/plot	10
	NA	Sagebrush	Composite of greater than 5 plants/plot	10
	NA	Crested wheatgrass[a]	Composite of greater than 5 plants/plot	10

Note: No duplicates for biota will be collected. The laboratory will prepare matrix duplicates from the appropriate digestates.
a. Or other wheatgrasses, as appropriate. See Appendix B, Section B2.1.1.
NA = not applicable.

Table 4-5. Biased composite biotic and collocated samples for contaminant analysis at the aquatic reference area.

Analytes	Sample Depth	Sample Media	Sample Type	Number of Samples
Selected metals	0 to 15 cm (0 to 6 in.)	Sediment	Grab sample from randomly located grid cell	5
	NA	Surface water	Grab sample from randomly located grid cell	5
	NA	Aquatic plant	Composite of five plants	5
Selected radionuclides	0 to 15 cm (0 to 6 in.)	Sediment	Grab sample from randomly located grid cell	5
	NA	Surface water	Grab sample from randomly located grid cell	5
	NA	Aquatic plant	Composite of five plants	5

Note: No duplicates for biota will be collected. The laboratory will prepare matrix duplicates from the appropriate digestates.
NA = not applicable.

The INEEL SAM Program is responsible for obtaining laboratory services for the required analyses in accordance with MCP-9439, "Preparation for Environmental Sampling Activities at the INEEL." The SAM Program will prepare two statement of work (SOW) documents for laboratory services. One will be entitled "Radiological Analyses of Samples Collected for the Long-Term Ecological Monitoring for 2004 at the INEEL" (ER-SOW-472). The other will be titled "Organic, Inorganic, and Miscellaneous Classical Analyses of Samples Collected for the Long-Term Ecological Monitoring for 2004 at the INEEL" (ER-SOW-473). These SOWs will include the analytical methods and the project-required detection limits for each analysis type listed in the Appendix A sampling and analysis plan tables and field guidance forms. Detection limits for each analysis type are included in Table 1-2.

Samplers coordinate with the analytical laboratory to ensure that the samples arrive at the laboratory to meet holding times. Holding times for biota samples are not established; however, approval of holding times of 6 months to 1 year is likely based upon other ecological studies (Marsh et al. 1996). Biotic samples will be preserved by refrigeration.

When required, quality control samples will be collected. If for some reason a sample is lost, containers are broken, or the sample is in some way unusable, then the sample will be retaken. The sampling FTL will ensure that any changes to this document regarding sampling frequency, location, and/or analyses are documented in the sample logbook. The project manager is responsible for ensuring that a Document Action Request (DAR) (Form 412.11) is written and approved for any changes to this document.

A sampling logbook containing a written record for all field data gathered, field observations, field equipment calibrations, samples collected for analysis, and sample custody will be prepared. Field logbooks are legal documents that are maintained to ensure that field activities are documented properly as they relate to site safety meetings and site work being conducted in accordance with the health and safety procedures. Field logbooks are bound and contain consecutively numbered pages. All entries in field logbooks are made using permanent ink pens or markers. The person making corrections to an entry should draw a single line through the entry and then initial and date the correction. Data sheets will be used to collect data about plants, birds, soils, reptiles, and small mammals. The FTL will note the use of data sheets in the appropriate logbook.

4.1.3 Sample Documentation and Management

The FTL controls and maintains all field documents and records and submits required documents to the Administrative Record and Document Control Office at the project's end. The appropriate information pertaining to each sample is recorded in accordance with MCP-1194, "Logbook Practices for ER and D&D&D Projects"; MCP-1192, "Chain-of-Custody and Sample Labeling for ER and D&D&D Projects"; and the QAPjP (DOE-ID 2002b). The person designated to complete the sample or FTL logbook records items (such as presampling safety meeting notes, weather, and general project notes) in the logbook, as appropriate. Proper handling, management, and disposal of samples under the control of Bechtel BWXT Idaho, LLC, or its subcontractors are essential. All samples are dispositioned in accordance with the appropriate procedures.

If it becomes necessary to revise these documents or other project documents, a DAR will be executed in accordance with MCP-233, "Process for Developing, Releasing, and Distributing ER Documents (Supplemental to MCP-135 & MCP-9395)." The DARs can include additional analyses that might be necessary to meet appropriate waste acceptance criteria.

4.1.4 Sampling Equipment

Table 4-6 includes a list of equipment and supplies similar to the list presented in TPR-145, "Biotic and Proximal Soil Sampling." This list is as extensive as possible and includes equipment for both the analytical and effects data collection; however, it is not exhaustive and should only be used as a guide.

Table 4-6. Equipment and supplies list.

	Plot Preparation	Proximal Soil Sampling	Mammal Sampling		Vegetation Sampling	
			Effects	Analytical	Effects	Analytical
Flexible tape, 50 m or longer	X	X		X		X
Rulers	X	X		—		X
Survey stakes	X	—		X		X
Field forms, logbooks, and clipboards	X	X		X		X
Flagging tape (various colors)	X	X		X		X
Wildlife identification information	—	—		X		—
Small (mouse-sized) and medium (rabbit-sized) live traps	—	—		X		—
Absorbent material (e.g., paper towels and cloth rags)	—	X		X		X
Permanent markers, sample labels, and bar codes	X	X		X		X
Latex/nitrile gloves	—	X		X		X
EPA-approved sampling containers as specified by the analytical method (see QAPjP)	—	X		X		X
Logbooks						
Sealable plastic bags (various sizes)	—	X		X		X
Strapping tape and duct tape	—	X		X		X
Data sheets	—	—	X	—	X	—

Table 4-6. (continued).

	Plot Preparation	Proximal Soil Sampling	Mammal Sampling		Vegetation Sampling	
			Effects	Analytical	Effects	Analytical
Distilled, deionized water (including decontamination water)	—	X		X		X
Sample preservatives as specified by analytical method (see FSP and QAPjP)	—	X		—		—
Plastic tubs for rinsing sampling equipment	—	X		X		X
Tweezers, tongs, and forceps	—	—		X		X
PPE, as specified by the JSA	X	X		X		X
Plastic bubble-wrap, starch packing beads, or foam sheeting for sample shipment (no diatomaceous earth)	—	X		X		X
Laboratory scales: 2-kg capacity with 0.1-g resolution; 200-g capacity with 0.01-g resolution	—		X	X		X
Global positioning system unit	X	—		—		—
Bleach for decontaminating traps and sampling tools	—	—		X		—
Scales for weighing animals (various sizes)	—	—		X		—
Stainless-steel pans	—	X		X		X
Stainless-steel scoops for soil sampling	—	X		—		—
Stainless-steel auger	—	X		—		—
Plastic containers (e.g., carboys) for containing used rinse water	—	X		X		X
Leather gloves (various sizes)	X	X		X		X
Plant press	—	—		—		X
Large and small coolers	—	X		X		X
Reusable ice packs	—	X		X		X
Shovels	X	—		—		—
Grass clippers	—	—		—		X
Pruning shears	—	—		—		X
Bait (peanut butter, molasses, grain)						

EPA = U.S. Environmental Protection Agency
FSP = field sampling plan
JSA = job safety analysis
PPE = personal protective equipment
QAPjP = Quality Assurance Project Plan

4.1.4.1 Field Equipment Calibration and Set-Up.

The FTL works closely with sampling personnel to ensure that sampling equipment is operating as recommended by the manufacturer and according to design specifications. Presampling inspections of equipment are conducted to ensure that the equipment is functioning properly. Corrective actions for repair or maintenance of any sampling equipment will be immediate and confirmed by the FTL or project manager before proceeding with sampling.

Radiological control personnel are responsible for calibrating radiological monitoring equipment and placing and handling the telemetry dosimeters. Industrial Hygiene is responsible for measuring and evaluating chemical hazards. All calibrations will be documented in the calibration logbooks.

4.1.5 Sample Designation and Labeling

Each sample bottle contains a label identifying the field sample number, the analyses requested, the sample date and time, and the sampler. Labels are secured on the sample using clear plastic tape.

Uniqueness is required for maintaining consistency and preventing the same identification code being assigned to more than one sample. A systematic character code may be used to uniquely identify all samples.

4.1.6 Chain of Custody

Chain-of-custody (COC) procedures begin immediately after collecting the first sample. At the time of sample collection, the sampling team initiates a COC form for each sample. All samples remain in the custody of a sampling team member until custody is transferred to the analytical laboratory sample custodian. Upon receipt at the laboratory, the sample custodian reviews the sample labels and the COC form to ensure completeness and accuracy. If discrepancies are noted during this review, immediate corrective action is sought with the sampling team member(s) relinquishing custody as identified on the COC. Pending successful corrective action, the laboratory sample custodian signs and dates the COC form, signifying acceptance of delivery and custody of the samples.

4.1.7 Sample Collection Procedures

Samples will be collected follows using the procedures in Appendix B and in TPR-145, “Biotic and Proximal Soil Sampling,” and GDE-279, “Surface Water Sampling for the Idaho Completion Project.”

4.1.8 Equipment Decontamination Procedures

Decontamination of most sampling equipment will be accomplished using guidance in GDE-282, “Decontaminating Ecological Sampling Equipment.”

4.1.9 Sample Transport

Field team members will prepare the samples for transport in accordance with MCP-1193, “Handling and Shipping Samples for ER and D&D&D Projects,” by securing the labels using clear tape, placing parafilm or stretch tape on the bottles to secure the lids, and placing the bottles in sealed bags. The field team member will wrap the samples in cushioning material and place them in the sample cooler. If necessary, the field team member will place Blue Ice (or equivalent) in the cooler to maintain the required temperature. The field team member will place the completed and signed COC form in the cooler, tape the cooler shut, and place the custody seals on the cooler to prevent tampering.

The field team member will complete the applicable shipping papers (Form Series 460 or 461, as applicable), secure address labels to the cooler, and deliver the coolers to the shipping authority for transport.

4.1.10 Waste Management

All samples will be dispositioned under the guidance of the project WGS representative. The analytical laboratory will dispose of samples submitted to it for analyses or will return them to the requestor as stated in the applicable task order statement of work(s). Samples returned from the laboratory will be accepted only if the original label is intact and legible. If the samples are returned, then the project manager is responsible for properly disposing of the sample with the assistance of WGS personnel. All waste must be characterized. Disposal must be preapproved and documented by WGS personnel.

4.1.10.1 Solid Waste Management. Solid waste generated will include PPE trash and miscellaneous waste such as wipes and packaging. Waste that does not come into direct contact with the sampled media or sampling equipment can be disposed of as nonconditional, nonradioactive waste at the Central Facilities Area landfill complex unless beta/gamma radiation or contamination above INEEL release criteria is detected.

All PPE and other waste material directly used in sampling, decontamination, etc., will be bagged and placed in containers recommended by WGS, which ensures proper disposition of the waste.

In the unlikely event that nonhazardous radioactive waste is generated, it will be disposed of at the Radioactive Waste Management Complex. WGS will approve and prepare individual waste streams destined for disposal at the Radioactive Waste Management Complex or the Waste Experimental Reduction Facility in accordance with *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (DOE-ID 2002c).

4.1.10.2 Soil-Specific Waste Management. Off-Site laboratories will dispose of both altered and unaltered samples as contractually required. However, as mentioned previously, on-Site laboratory gamma screening of samples might be required, although it is not expected. On-Site laboratories will not dispose of soil samples. Generally, returned samples should be restored to the collection site. In the event that samples must be returned from the laboratory, only unused and unaltered samples in the original containers will be accepted. Although no samples are expected to be returned from any laboratory, and all samples are expected to be eligible for return to the collection site, disposition of samples that are returned (for whatever reason) and that cannot be restored to a collection site is coordinated with the appropriate waste-generator interface. Such coordination will help to ensure compliance with applicable waste characterization, treatment, and disposal regulations.

Decontamination solutions used in small quantities might include deionized water, detergent, bleach/water, and isopropanol. It is anticipated that no decontamination fluids requiring containment will be generated during sampling. Using spray bottles to apply the fluids will minimize the amount of decontamination fluids produced. Excess fluid will be allowed to drain onto the ground in the staging area used during sampling.

4.1.10.3 Waste Minimization. Waste reduction philosophies and techniques will be emphasized, and personnel will be encouraged to continuously attempt to improve methods. Personnel must not use, consume, spend, or expend equipment or materials carelessly. Practices to be instituted to support waste minimization include, but are not limited to, the following:

- Restrict material (especially hazardous material) entering control zones to that needed to do the work.

- Substitute recyclable or burnable items for disposable items.
- Reuse items when practical.
- Segregate contaminated from uncontaminated waste.
- Segregate reusable items such as PPE and tools.

Waste generated during the characterization project includes samples, sampling equipment, and PPE. These articles are handled, characterized, and disposed of in accordance with the *Idaho National Engineering and Environmental Laboratory Waste Acceptance Criteria* (DOE-ID 2002c). Personnel from WGS coordinate waste-disposal activities in accordance with INEEL procedures. Waste will be bagged, placed in containers, labeled, and stored in an approved storage area pending disposition. The project manager, with assistance from WGS, will prepare waste-determination and disposition forms for determining the disposition routes for all waste generated during sampling and analysis.

4.2 Sample Analysis

Laboratories approved by the INEEL SAM Program will analyze the samples in accordance with project requirements, including ER-SOW-394, "Idaho National Engineering and Environmental Laboratory Sample and Analysis Management Statement of Work for Analytical Services."

Project-specific, request-for-analyses forms or task order statement(s) of work identify additional requirements for laboratory analysis. The following subsections identify analysis requirements for the characterization project.

4.2.1 Analytical Methods

To ensure that data of acceptable quality are obtained from the characterization project, standard EPA laboratory methods or technically appropriate methods for analytical determinations will be used to obtain sample data. The SAM Program is responsible for obtaining laboratory analytical services for the required analyses in accordance with MCP-9439, "Preparation for Environmental Sampling Activities at the INEEL." The SAM Program will prepare two SOW documents for laboratory services. One will be entitled "Radiological Analyses of Samples Collected for the Long-Term Ecological Monitoring for 2004 at the INEEL" (ER-SOW-472). The other will be entitled "Organic, Inorganic, and Miscellaneous Classical Analyses of Samples Collected for the Long-Term Ecological Monitoring for 2004 at the INEEL" (ER-SOW-473). These SOWs (along with Table 1-2) will include the analytical methods and the project-required detection limits for each analysis type listed in the Appendix A sampling and analysis plan tables and field guidance forms. Project-specific detection limits are presented in Table 1-2. Any deviations from this information will be fully documented, and the laboratory will inform the technical lead of the deviations. Methods for other less-typical activities, such as histopathic inspection of deer mice liver and kidney samples, will follow the contracted laboratory's standard protocol. Bioassays (earthworm and seedling toxicity tests) will be performed to appropriate standards of the American Society for Testing and Materials or other accepted methods, as determined by the technical lead.

4.2.2 Instrument Calibration Procedures

Laboratory instruments are calibrated in accordance with each of the specified analytical methods. The laboratory quality assurance plan must include requirements for calibrations when specifications are not listed in analytical methods. Calibrations that are typically not called out in analytical methods include ancillary laboratory equipment and verification of reference standards used for calibration and standard preparation. Laboratory documentation includes calibration techniques and sequential calibration actions,

performance tolerances provided by the specific analytical method, and dates and frequency of the calibrations. All analytical methods have specifications for equipment checks and instrument calibrations. The laboratory complies with all method-specific calibration requirements for all requested parameters. If failure of instrument calibration or equipment is detected, then the instrument will be recalibrated, and all affected samples will be analyzed using an acceptable calibration.

4.2.3 Laboratory Records

Laboratories that analyze the samples are required to keep records of sample receipt, processing, analysis, and data reporting. Sample-management records must document sample receipt, sample handling and storage, and the sample analysis schedule. The records will be used to verify that the COC and proper preservation are maintained, document anomalies in the samples, note proper log-in of samples into the laboratory, and address procedures used to prioritize received samples, thereby ensuring that the holding time requirements are met.

The laboratory is responsible for maintaining documentation that demonstrates laboratory proficiency with each method as prescribed in standard operating procedures. Laboratory documentation includes sample preparation and analysis details, instrument standardization, detection and reporting limits, and test-specific quality control criteria. Any deviations from prescribed methods must be recorded properly. Quality assurance/quality control reports will include general quality control records on activities such as analyst training, instrument calibration, routine monitoring of analytical performance, and calibration verification. Project-specific information (such as blanks, spikes, calibration check samples, replicates, and splits performed in accordance with project requirements) may be performed and documented. Specific requirements for the quantity and types of quality assurance/quality control monitoring and associated reporting formats will be specified in the task-specific laboratory SOW.

4.3 Data Management and Document Control

4.3.1 Data Reporting

A basic ordering agreement standard deliverable is required for all data reported for this characterization project. The final data documentation package will conform to the criteria specified in ER-SOW-394.

The Environmental Restoration (ER) SOW, prepared by the INEEL SAM Program, will be the standard for analytical data deliverable requirements for the laboratories used by the INEEL. All laboratories associated with this project will adhere to the document used to establish technical and reporting standards.

4.3.2 Data Validation

Analytical data validation is the comparison of analytical results with the requirements established by the analytical method. Validation involves evaluating all sample-specific information generated from sample collection to receipt of the final data package. Data validation is used to determine whether analytical data are technically and legally defensible and reliable. The final product of the validation process is the validation report. The validation report communicates the quality and usability of the data to the decision-makers.

All data generated for this project will undergo independent validation. The INEEL SAM Program arranges for validation. Level B validation is requested for all sample data reports generated during this project. The validation report contains an itemized discussion of the validation process and results. Copies of the data forms annotated for qualification are attached to the validation report.

4.3.3 Data Quality Assessment

The data quality assessment process will be used to ascertain whether the data meet the project DQOs. Additional steps of the data quality assessment process may involve data plotting, testing for outlying data points, and other statistical analyses relative to the characterization project DQOs.

For this characterization plan, a 90% completeness objective for all analyses has been established, because some sample locations might not contain enough material for all analyses requested. The completeness of the data is the number of samples collected and analyzed compared to the number of samples planned.

Precision is a measure of agreement among replicate measurements of the same property. Accuracy is a measure of the closeness of an individual measurement to the true value. Field and laboratory precision and accuracy should be within the limits and goals mentioned in the QAPjP. Data results will be evaluated upon project completion to determine whether precision and accuracy goals have been met.

4.3.4 Final Characterization Report

A final characterization report will be prepared for this project in accordance with applicable program requirements. The final report will contain a summary of all sample data generated during this sampling effort. Appendixes containing all sample results may be attached. The final report also will describe the sample collection effort. A description of the data quality assessment process also may be included. The final report will discuss how the data will be used. The DQOs will be reviewed and evaluated to determine whether the characterization project objectives have been met.

4.3.5 Document Control

Document control consists of clearly identifying all project-specific documents in an orderly form, securely storing all project information, and controlling the distribution of all project information. Document control will ensure that controlled documents of all types related to the project receive appropriate levels of review, comment, and revision (as necessary). The project manager is responsible for properly maintaining project documents according to INEEL document control requirements. Upon completion of the characterization project, all project documentation and information will be transferred to compliant storage according to project, program, and company requirements. This information may include field logbooks, COC forms, laboratory data reports, engineering calculations and drawings, and final technical reports.

5. HEALTH AND SAFETY REQUIREMENTS

A health and safety plan is not required for this project. Instead, a hazard screening checklist was completed for this characterization activity in accordance with the requirements of MCP-3562, "Hazard Identification, Analysis, and Control of Operational Activities," to identify hazards associated with this project. Hazards identified on the checklist, along with corresponding mitigation requirements, are documented on a JSA in accordance with MCP-3450, "Developing and Using Job Safety Analyses." By virtue of completing the JSA, technical input and approval will be obtained from assigned ESH&QA personnel. The JSA identifies the potential hazards associated with this project.

6. REFERENCES

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Appendix A

Sampling and Analysis Plan Tables

FIELD GUIDANCE FORM

Project Name: LONG TERM ECOLOGICAL MONITORING
SAP Table #: LTS_ECM_2004

SMO POC: MCGRIFF, T. W.
Phone: (208)526-2775

Please contact the SMO POC with any questions regarding sample volume requirements.

TOS Number: ER-SOW-472

Laboratory Information:

General Engineering Laboratory
2040 Savage Road
Charleston, SC 29407

POC: Julie Strock
Phone: 843-556-8171

ANIMAL BIOTA

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Radiochemistry - Suite 1/Radiological Suite #1	60 g	4°C	Ziplock Bag	180 days

PLANT BIOTA

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Radiochemistry - Suite 1/Radiological Suite #1	260 g	4°C	Ziplock Bag	180 days

SEDIMENT

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Radiochemistry - Suite 1/Radiological Suite #1	260 g	4°C	250 mL Glass	180 days

SOIL

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Radiochemistry - Suite 1/Radiological Suite #1	260 g	4°C	250 mL Glass	180 days

WATER

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Radiochemistry - Suite 1/Radiological Suite #1	2 L	HNO3 to pH<2	2 - 1000 mL HDPE Bottle	180 days

FIELD GUIDANCE FORM

Project Name: LONG TERM ECOLOGICAL MONITORING
SAP Table #: LTS_ECM_2004

SMO POC: MCGRIFF, T. W.
Phone: (208)526-2775

Please contact the SMO POC with any questions regarding sample volume requirements.

Please include all applicable screening data with the COC, and contact the laboratory POC prior to shipping samples.

Radionuclide Sample:

Double volume is required for one aqueous sample for each analysis type for each SDG to satisfy the quality control requirements.

Organic Sample:

Triple volume is required for one aqueous sample for each analysis type for each SDG to allow for required laboratory MS/MSD analyses.

This form is for information only.
If there are any questions regarding the information on this form please contact the SAM POC.

FIELD GUIDANCE FORM

Project Name: LONG TERM ECOLOGICAL MONITORING
SAP Table #: LTS_ECM_2004

SMO POC: MCGRIFF, T. W.
Phone: (208)526-2775

Please contact the SMO POC with any questions regarding sample volume requirements.

TOS Number: ER-SOW-473

Laboratory Information:

Southwest Research Institute
6220 Culebra Road
San Antonio, TX 78238-5166

POC: Mike Dammann
Phone: 210-522-5428

ANIMAL BIOTA

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Histapthy/Histopathy	tissue	10% BUFFERED FORMALIN SOLUTION, 4 C	2 oz Glass	as soon as possible
Mercury/Mercury	20 g	4°C	Ziplock Bag	28 days
Nitroaromatics (8330)/Nitroaromatics	5 g	4°C	Ziplock Bag	14 days
Total Metals (TAL)/Total Metals	20 g	4°C	Ziplock Bag	180 days

PLANT BIOTA

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Mercury/Mercury	20 g	4°C	Ziplock Bag	14 days
Nitroaromatics (8330)/Nitroaromatics	5 g	4°C	Ziplock Bag	14 days
Total Metals (TAL)/Total Metals	100 g	4°C	Ziplock Bag	180 days

SEDIMENT

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Cyanide/Total Cyanide	150 g	4°C, NO HEADSPACE	250 mL Amber Glass or Plastic	14 days
Hydrogen Ion (pH)/Hydorgen Ion (pH)	50 g	4°C	60 mL Glass or Plastic	analyze as soon as possible
Mercury/Mercury	100 g	4°C	250 mL Glass	28 days
Total Metals (TAL)/Total Metals	100 g	4°C	250 mL Glass	180 days

SOIL

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Analysis Suite #1/Analysis Suite #1	container	4°C	250 mL Glass	analyze as soon as possible
Analysis Suite #2/Analysis Suite #2	4 gal	4°C	5 gal Bucket	analyze as soon as possible
Cyanide/Total Cyanide	150 g	4°C, NO HEADSPACE	250 mL Amber Glass or Plastic	14 days

FIELD GUIDANCE FORM

Project Name: LONG TERM ECOLOGICAL MONITORING
SAP Table #: LTS_ECM_2004

SMO POC: MCGRIFF, T. W.
Phone: (208)526-2775

Please contact the SMO POC with any questions regarding sample volume requirements.

Mercury/Mercury	100 g	4°C	250 mL Glass	28 days
Mesoarthopod/Mesoarthropod	core	None, Analyze Immediately	Ziplock Bag	analyze as soon as possible
Nitroaromatics (8330)/Nitroaromatics	5 g	4°C	250 mL Glass	14 days
Total Metals (TAL)/Total Metals	100 g	4°C	250 mL Glass	180 days

WATER

Analysis Description/TOS Analysis Type #	Min. Sample Quantity	Preservative	Container	Hold Time
Cyanide/Total Cyanide	1500 mL	NaOH to pH >12, 4°C, no headspace	2 - 1 L Amber Glass or Plastic	14 days
Mercury/Mercury	300 mL	5 mL/L of 12 N HCl	500 mL HDPE Bottle	28 days
Total Metals (TAL)/Total Metals	1800 mL	HNO3 to pH<2	2 - 1 L Glass or Plastic	180 days

Please include all applicable screening data with the COC, and contact the laboratory POC prior to shipping samples.

Radionuclide Sample:

Double volume is required for one aqueous sample for each analysis type for each SDG to satisfy the quality control requirements.

Organic Sample:

Triple volume is required for one aqueous sample for each analysis type for each SDG to allow for required laboratory MS/MSD analyses.

This form is for information only.
If there are any questions regarding the information on this form please contact the SAM POC.

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

05/25/2004 01:57 PM

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECR061	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR062	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR063	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR064	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR065	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR066	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR067	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR068	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR069	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR070	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	REFERENCE AREA	NA				5		1		1	1	1											
ECR071	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						2		2	2	2											
ECR072	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR073	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR074	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR075	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECR076	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR077	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR078	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR079	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR080	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	REFERENCE AREA	NA						1		1	1	1											
ECR081	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						2		2	2	2											
ECR082	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR083	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR084	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR085	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR086	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR087	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR088	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR089	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											
ECR090	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	REFERENCE AREA	NA						1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECR091	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	NA	2					2		2	2	2											
ECR092	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR093	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR094	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR095	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR096	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR097	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR098	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR099	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR100	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOILS	REFERENCE AREA	0-2 INCHES	1					1		1	1	1											
ECR101	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	2					2		2	2	2											
ECR102	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1											
ECR103	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1											
ECR104	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1											
ECR105	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																					
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECR106	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1										
ECR107	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1										
ECR108	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1										
ECR109	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1										
ECR110	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	REFERENCE AREA	2-24 INCHES	1					1		1	1	1										
ECR111	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		2					2													
ECR112	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR113	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR114	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR115	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR116	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR117	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR118	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR119	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													
ECR120	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	REFERENCE AREA	0-12 INCHES		1					1													

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The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECR121	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	REFERENCE AREA	MACKAY RES						1			1	1										
ECR122	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	REFERENCE AREA	MACKAY RES						1			1	1										
ECR123	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	REFERENCE AREA	MACKAY RES						1			1	1										
ECR124	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	REFERENCE AREA	MACKAY RES						1			1	1										
ECR125	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	REFERENCE AREA	MACKAY RES						1			1	1										
ECR126	REG	WATER	GRAB	COMP	09/20/04	INEEL	POND WATER	REFERENCE AREA	MACKAY RES			1			1			1	1										
ECR127	REG	WATER	GRAB	COMP	09/20/04	INEEL	POND WATER	REFERENCE AREA	MACKAY RES			1			1			1	1										
ECR128	REG	WATER	GRAB	COMP	09/20/04	INEEL	POND WATER	REFERENCE AREA	MACKAY RES			1			1			1	1										
ECR129	REG	WATER	GRAB	COMP	09/20/04	INEEL	POND WATER	REFERENCE AREA	MACKAY RES			1			1			1	1										
ECR130	REG	WATER	GRAB	COMP	09/20/04	INEEL	POND WATER	REFERENCE AREA	MACKAY RES			1			1			1	1										
ECR131	REG	ANIMAL BIOTA	GRAB	COMP	09/20/04	INEEL	TADPOLE/FROG	REFERENCE AREA	MACKAY RES						1			1	1										
ECR132	REG	ANIMAL BIOTA	GRAB	COMP	09/20/04	INEEL	TADPOLE/FROG	REFERENCE AREA	MACKAY RES						1			1	1										
ECR133	REG	ANIMAL BIOTA	GRAB	COMP	09/20/04	INEEL	TADPOLE/FROG	REFERENCE AREA	MACKAY RES						1			1	1										
ECR134	REG	ANIMAL BIOTA	GRAB	COMP	09/20/04	INEEL	TADPOLE/FROG	REFERENCE AREA	MACKAY RES						1			1	1										
ECR135	REG	ANIMAL BIOTA	GRAB	COMP	09/20/04	INEEL	TADPOLE/FROG	REFERENCE AREA	MACKAY RES						1			1	1										

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AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECR136	REG	SEDIMENT	GRAB	COMP	09/20/04	INEEL	SEDIMENT	REFERENCE AREA	MACKAY RES			1		1	1			1	1										
ECR137	REG	SEDIMENT	GRAB	COMP	09/20/04	INEEL	SEDIMENT	REFERENCE AREA	MACKAY RES			1		1	1			1	1										
ECR138	REG	SEDIMENT	GRAB	COMP	09/20/04	INEEL	SEDIMENT	REFERENCE AREA	MACKAY RES			1		1	1			1	1										
ECR139	REG	SEDIMENT	GRAB	COMP	09/20/04	INEEL	SEDIMENT	REFERENCE AREA	MACKAY RES			1		1	1			1	1										
ECR140	REG	SEDIMENT	GRAB	COMP	09/20/04	INEEL	SEDIMENT	REFERENCE AREA	MACKAY RES			1		1	1			1	1										
ECT061	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT062	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT063	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT064	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT065	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT066	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT067	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT068	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT069	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										
ECT070	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	INTEC	NA				5		1			1	1										

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AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

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AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECT071	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						2			2	2											
ECT072	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT073	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT074	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT075	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT076	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT077	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT078	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT079	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT080	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	INTEC	NA						1			1	1											
ECT081	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						2			2	2											
ECT082	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1											
ECT083	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1											
ECT084	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1											
ECT085	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

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Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECT086	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1										
ECT087	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1										
ECT088	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1										
ECT089	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1										
ECT090	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	INTEC	NA						1			1	1										
ECT091	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	2					2			2	2										
ECT092	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT093	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT094	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT095	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT096	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT097	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT098	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT099	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										
ECT100	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	INTEC	0-2 INCHES	1					1			1	1										

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECT101	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	2					2			2	2										
ECT102	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT103	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT104	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT105	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT106	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT107	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT108	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT109	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT110	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	INTEC	2-24 INCHES	1					1			1	1										
ECT111	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		2					2													
ECT112	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1													
ECT113	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1													
ECT114	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1													
ECT115	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1													

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

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AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECT116	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1														
ECT117	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1														
ECT118	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1														
ECT119	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1														
ECT120	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	INTEC	0-12 INCHES		1					1														
ECT121	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	TSF-07	NA				10		2		2	2	2											
ECT122	REG/QC	PLANT BIOTA	GRAB	COMP	09/20/04	INEEL	SAGEBRUSH	TSF-07	NA						2			2	2											
ECT123	REG/QC	PLANT BIOTA	GRAB	COMP	09/20/04	INEEL	CRESTED WHEATGR	TSF-07	NA						2			2	2											
ECT124	REG/QC	SOIL	DUP	COMP	09/20/04	INEEL	SURFACE SOIL	TSF-07	0-2 INCHES	2		2			2			2	2											
ECT125	REG/QC	SOIL	DUP	COMP	09/20/04	INEEL	SUBSURFACE SOIL	TSF-07	2-24 INCHES	2					2			2	2											
ECT126	REG/QC	SOIL	DUP	COMP	09/20/04	INEEL	SOIL	TSF-07	0-12 INCHES		2				2			2	2											
ECT127	REG	ANIMAL BIOTA	COMP	GRAB	09/20/04	INEEL	TADPOLE/FROG	TSF-07	NA						1			1	1											
ECT128	REG	ANIMAL BIOTA	COMP	GRAB	09/20/04	INEEL	TADPOLE/FROG	TSF-07	NA						1			1	1											
ECT129	REG	ANIMAL BIOTA	COMP	GRAB	09/20/04	INEEL	TADPOLE/FROG	TSF-07	NA						1			1	1											
ECT130	REG	ANIMAL BIOTA	COMP	GRAB	09/20/04	INEEL	TADPOLE/FROG	TSF-07	NA						1			1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

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AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

05/25/2004 01:57 PM

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECT131	REG	ANIMAL BIOTA	COMP	GRAB	09/20/04	INEEL	TADPOLE/FROG	TSF-07	NA						1			1	1											
ECT132	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	TSF-07	NA						1			1	1											
ECT133	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	TSF-07	NA						1			1	1											
ECT134	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	TSF-07	NA						1			1	1											
ECT135	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	TSF-07	NA						1			1	1											
ECT136	REG	PLANT BIOTA	COMP	GRAB	09/20/04	INEEL	CATTAIL	TSF-07	NA						1			1	1											
ECT137	REG	WATER	COMP	GRAB	09/20/04	INEEL	PONDWATER	TSF-07	NA			1			1			1	1											
ECT138	REG	WATER	COMP	GRAB	09/20/04	INEEL	PONDWATER	TSF-07	NA			1			1			1	1											
ECT139	REG	WATER	COMP	GRAB	09/20/04	INEEL	PONDWATER	TSF-07	NA			1			1			1	1											
ECT140	REG	WATER	COMP	GRAB	09/20/04	INEEL	PONDWATER	TSF-07	NA			1			1			1	1											
ECT141	REG	WATER	COMP	GRAB	09/20/04	INEEL	PONDWATER	TSF-07	NA			1			1			1	1											
ECT142	REG	SEDIMENT	COMP	GRAB	09/20/04	INEEL	SEDIMENT	TSF-07	NA			1		1	1			1	1											
ECT143	REG	SEDIMENT	COMP	GRAB	09/20/04	INEEL	SEDIMENT	TSF-07	NA			1		1	1			1	1											
ECT144	REG	SEDIMENT	COMP	GRAB	09/20/04	INEEL	SEDIMENT	TSF-07	NA			1		1	1			1	1											
ECT145	REG	SEDIMENT	COMP	GRAB	09/20/04	INEEL	SEDIMENT	TSF-07	NA			1	.	1	1			1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECT146	REG	SEDIMENT	COMP	GRAB	09/20/04	INEEL	SEDIMENT	TSF-07	NA			1		1	1			1	1											
ECX061	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX062	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX063	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX064	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX065	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX066	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX067	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX068	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX069	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX070	REG	ANIMAL BIOTA	GRAB	COMP	07/01/04	INEEL	DEER MOUSE	MDA	NA				5		1		1	1	1											
ECX071	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						2		2	2	2											
ECX072	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX073	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX074	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histapthy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECX075	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX076	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX077	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX078	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX079	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX080	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	SAGEBRUSH	MDA	NA						1		1	1	1											
ECX081	REG/QC	PLANT BIOTA	DUP	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						2		2	2	2											
ECX082	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX083	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX084	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX085	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX086	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX087	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX088	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX089	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

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Comments:

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Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA											
ECX090	REG	PLANT BIOTA	GRAB	COMP	07/01/04	INEEL	CRESTED WHEATGR	MDA	NA						1		1	1	1											
ECX091	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	2					2		2	2	2											
ECX092	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX093	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX094	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX095	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX096	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX097	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX098	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX099	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX100	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SURFACE SOIL	MDA	0-2 INCHES	1					1		1	1	1											
ECX101	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	2					2		2	2	2											
ECX102	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1											
ECX103	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1											
ECX104	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1											

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

AT2: Analysis Suite #2

AT3: Cyanide

AT4: Histaphy

AT5: Hydrogen Ion (pH)

AT6: Mercury

AT7: Mesoarthopod

AT8: Nitroaromatics (8330)

AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

AT11:

AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
										AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECX105	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX106	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX107	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX108	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX109	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX110	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SUBSURFACE SOIL	MDA	2-24 INCHES	1					1		1	1	1										
ECX111	REG/QC	SOIL	DUP	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		2					2													
ECX112	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX113	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX114	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX115	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX116	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX117	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX118	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													
ECX119	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number.

The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

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AT3: Cyanide

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AT9: Radiochemistry - Suite 1

AT10: Total Metals (TAL)

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AT12:

AT13:

AT14:

AT15:

AT16:

AT17:

AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Sampling and Analysis Plan Table for Chemical and Radiological Analysis

05/25/2004 01:57 PM

Plan Table Number: LTS_ECM_2004

SAP Number:

Sampler: Haney, T. J.

Date: 05/24/2004 Plan Table Revision: 0.0 Project: LONG TERM ECOLOGICAL MONITORING Project Manager: HANEY, T. J./VANHORN, R. L. SMO Contact: MCGRIFF, T. W.

Sample Description						Sample Location				Enter Analysis Types (AT) and Quantity Requested																				
Sampling Activity	Sample Type	Sample Matrix	Coll Type	Sampling Method	Planned Date	Area	Type of Location	Location	Depth (ft)	AT1	AT2	AT3	AT4	AT5	AT6	AT7	AT8	AT9	AT10	AT11	AT12	AT13	AT14	AT15	AT16	AT17	AT18	AT19	AT20
										3A	9A	C2	3Z	PH	HG	3Y	N7	RH	LA										
ECX120	REG	SOIL	GRAB	COMP	07/01/04	INEEL	SOIL	MDA	0-12 INCHES		1					1													

The sampling activity displayed on this table represents the first 6 to 9 characters of the sample identification number. The complete sample identification number will appear on the sample labels.

AT1: Analysis Suite #1

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AT18:

AT19:

AT20:

Comments:

Analysis Suites:

Analysis Suite #1: Moisture Content, Hydrogen Ion (pH), Cation Exchange Capacity

Analysis Suite #2: Earthworm Toxicity Test, Rye Grass Growth Test

Radiochemistry - Suite 1: Am-241, Gamma Spec, Pu-Iso, U-Iso, Sr-90

Contingencies:

Appendix B

Sample Collection Procedures

Appendix B

Sample Collection Procedures

B1. OVERVIEW

Sampling for long-term ecological monitoring (LTEM) occurs as presented in the *Long-Term Ecological Monitoring Plan for the Idaho National Engineering and Environmental Laboratory* (INEEL 2004). Efforts are directed at sampling to determine levels of contamination in the selected media and to detect possible effects. Levels of contamination in soil, deer mice, and plants are determined to validate the Operable Unit (OU) 10-04 ecological risk assessment (ERA) assumption of no migration of contamination off the areas of concern (AOCs) and to establish a baseline. Effects data are evaluated for soil fauna, plants, mammals, and avian receptors at the AOCs. This appendix presents the sampling procedures used to collect analytical and effects samples at each AOC:

1. Randomly select 10 plots in the site location grids designated for Fiscal Year (FY) 2004 sampling.

2. Prepare the plots by staking the corners and center and distributing mammal traps in 3-m (10-ft) intervals on the 100- × 100-m (110- × 110-yd) plot, as shown in Figure B-1 and discussed in Technical Procedure (TPR) -145,"Biotic and Proximal Soil Sampling."

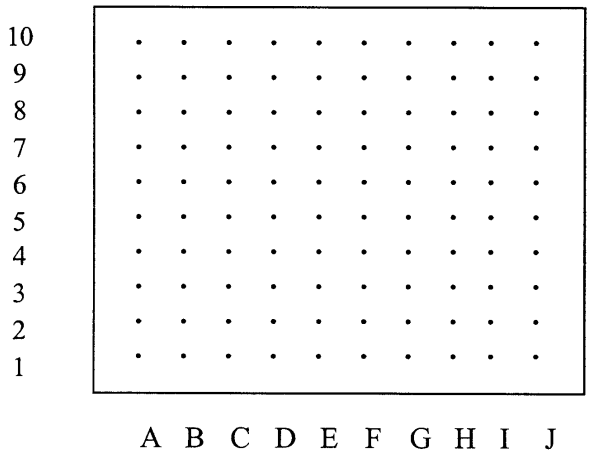

Figure B-1. Example of the transect design.

3. Obtain necessary paperwork, including safe work permits, scientific/trapping collection permits, and radiological work permits.

4. Obtain all sampling equipment, forms, and labels (as required).

5. Sample in the spring and early summer of 2004:

    a. During the first week:

        (1) Perform soil sampling for plant and earthworm bioassays, analytical concentrations, and soil fauna community structure determination with the Berlese funnel extraction procedure (the sampling procedure is presented in TPR-145).

        (2) Collect plant tissue for analysis.

    b. During the second week:

        (1) Sample the small mammal community structure, presence/absence, diversity/richness, and density/biomass using the trap and release methodology (the sampling procedure is presented in Subsection B3.1.3).

        (2) Sample the plant community structure, presence/absence, diversity/richness, and density/biomass (the sampling procedure is presented in Subsection B3.1.1).

        (3) Sample bird community structure, presence/absence, diversity/richness, and density/biomass (the sampling procedure is presented in Subsection B3.1.2).

    c. During the third week:

        (1) Sample deer mouse tissue to obtain effects and analytical data.

        (2) Harvest small mammals for analytical concentration determination (the sampling procedure is presented in TPR-145).

        (3) Harvest small mammals for organ to body weight measurements, histopathology, and genetic samples (the sampling procedure is presented in Subsection B3.4).

6. Decontaminate sampling equipment, the task site, and personnel (as necessary).

7. Prepare samples for storage and shipment to the appropriate facilities:

    a. Genetic samples will be delivered to the geneticist.

    b. Histopathology specimens will be shipped to the laboratory.

    c. Preserved invertebrates will be sent to the laboratory.

    d. Bioassay soils will be shipped to the laboratory for plant and earthworm toxicity bioassays.

    e. Soil samples will be shipped to the laboratory for chemical and radiological analysis.

    f. Plant and small mammal samples will be frozen and shipped to the laboratory for chemical and radiological analysis.

B2. ANALYTICAL SAMPLING PROCEDURES

B2.1 Biota Analytical Samples

Samples of vegetation, mammals, and soil will be collected for analysis of contaminant concentration.

B2.1.1 Vegetation Sampling Procedure for Analytical Sampling

Two types of vegetation (shrubs and grasses), representing the two most common functional plant types at the Idaho National Engineering and Environmental Laboratory (INEEL), will be collected for chemical analysis. A review of dietary information for herbivorous and omnivorous INEEL wildlife species has resulted in consideration of the following individual plant species and/or types:

- Wyoming big sagebrush (*Artemisia tridentata*)
- Crested wheatgrass (*Agropyron cristatum*)
- Hardstem bulrush (*Scirpus acutus).*

Sagebrush represents the shrub most commonly used by the INEEL's primary consumers, including the pronghorn, sage grouse, black-tailed jackrabbit, Nuttall's cottontail rabbit, and the pygmy rabbit. In addition, sagebrush is an important component in the diets of avian and mammalian omnivores and herbivorous insects. Wheatgrasses are most widely used and are significant components in the diets of jackrabbits, cottontail rabbits, birds, and small mammals. If crested wheatgrass is unavailable, or the amount is not sufficient, other wheatgrasses will be substituted. Hardstem bulrush nutlets are an important waterfowl and shorebird food, while muskrats and geese eat the rhizomes and stems.

Terrestrial vegetation samples will be collected during the early part of the growing season in conjunction with small mammal population analysis and tissue collection. Grass and sagebrush will be sampled in late May or June.

A field reconnaissance will be used to assess species presence and abundance within each randomly selected 100- × 100-m (110 × 110-yd) grid. If wheatgrass or sagebrush is unavailable, the nearest grid that contains a sufficient amount of these species will be evaluated. A field reconnaissance of potential reference areas also will be completed to match the reference area with the site areas to the greatest extent possible. Potential reference sampling areas with soil types similar to those onsite that have not been burned recently were identified in Figure 1-5. Final selection of the reference area and sampling grid cells will be based on the presence of suitable species and access.

Each vegetation tissue sample will be a composite of material from at least five individual plants of the same species. Individual plants should be randomly selected within a 20-m (22-yd) radial plot in each corner and center of the 100- × 100-m (110- × 110-yd) grid. Such plants also should be located at least 1 m (3.3 ft) apart, depending on size. Atypical individuals (i.e., resembles less than 5% of the plants for the area) based on size or herbivory should not be included. An approximately equal amount of vegetation should be collected from each individual plant.

Clean disposable gloves should be worn. Plant samples should be clipped with pruning shears or grass shears (as appropriate). Plant material from each of the five radial plots should be combined into

one plastic bag to make a composite sample. Sagebrush should be clipped on at least two sides and at two different heights to obtain a representative sample.

A minimum of 60 g of fresh biomass is required for radiological and metal analysis. If munitions analyses are required, an additional 30 g per analyte group is needed. Sample weight should be verified in the field to ensure that an adequate quantity has been collected. Plant samples should be placed into a sealable plastic bag that has been placed into another sealable plastic bag. Sharp points on woody vegetation should be bent or broken off within the bag to avoid bag puncture. Bags should be labeled, and the field data should be recorded in notebooks or on field data sheets. Samples should be placed in a cooler on ice until frozen or shipped to the laboratory. Field data will be recorded.

Grass samples should be collected by clipping above ground level (e.g., 1.3 to 5.1 cm [e.g., 0.5 to 2 in.]) with grass shears. Clipping should be adjusted, as needed, to minimize sampling dead vegetation from previous years and to maximize sampling green vegetation from the current growing season. All material above the cutting height will be collected. Dead material should be removed from the sample by hand if unavoidably collected. Grass samples will include new growth of leaves, stems, and any inflorescences present on the plants. It is desirable to remove as much dead material as possible; however, this might be impractical, and an estimate of the percentage of dead material should be noted.

Shrub samples should be collected using pruning shears. Collected material will include leaf and stem growth from the current season. Shrubs should be clipped at a height between 0.5 and 1.5 m (0.55 and 1.6 yd) on at least two sides. It is common to also collect woody material during this process. Stripping fresh leaves and stems from the woody material might be necessary. In the event that woody material is not removed, the sampler should make an estimate of the remaining amount.

Macrophytic aquatic plants should be collected along the margins of the wastewater ponds and the Big Lost River Sinks. One composite sample will be collected at each aquatic sample location. The aboveground portion of each plant should be cut and placed in a labeled heavy-duty plastic bag and then placed in a cooler with ice for transport to the analytical laboratory.

These procedures can be modified in the field as, appropriate, based on the professional judgment of the field team leader (FTL). All modifications will be documented in the field logbook or on the field sampling data sheets. Soil samples collocated with the plant tissue samples (i.e., from within the center of each 20-m [22-yd] radial plot in each corner and within the center of the 100- × 100-m [110- × 110-yd] grid) also will be collected.

B2.1.2 Mammal Sampling Procedure for Analytical Sampling

One small mammal species, the deer mouse *(Peromyscus maniculatus),* representing the major links between primary and secondary consumers and higher predators, will be collected for tissue analyses. The deer mouse is a primary prey item for both secondary and tertiary consumers. This species is commonly used to represent several important linkages in the food chain and is the primary choice, because it is omnivorous, widespread, and relatively easy to collect.

Collection of animal samples will be in accordance with applicable sections of TPR-145 and the following information. Deer mice will be collected for tissue analysis. It will be necessary to collect several deer mice for each analysis to obtain the 60 g of tissue required. Deer mice will be composited to obtain the required tissue amounts. Compositing will not include segregation of small mammals by sex or age but will be limited to the single species. Small mammal species—other than deer mice—will be weighed, photographed, have other life history or details recorded in the field logbook, and released.

The deer mouse samples will not be washed before homogenization. The intent of this sample preparation is to evaluate the body parts that a predator is most likely to consume. By incorporating all unwashed biotic tissue, all available contaminants in each sample will be assessed; however, not all of the analytes are necessarily bioavailable.

The same trapping design (see Subsection B3.1.3) used to evaluate small mammal population/community data will be used to collect deer mouse tissue samples for analytical assessment. Ten trapping locations or sample plots will be used in each grid. Each sample plot will require a 2- to 3-week trapping period and will consist of 100 traps placed along 10 parallel transect lines (10 traps on each). Each of the transects will follow a roughly straight line 100 m (110 yd) long. An example of the transect design is shown in Figure B-1.

Traps will be left open 4 nights, closed 3 nights, and then reopened an additional 4 nights. Once an animal is trapped, a uniquely numbered ear tag will be attached. The ear tag correlates with the trap location, genus, species, collector's initials, and date recorded in a field logbook. The animal should be emptied into a plastic bag. It should be sexed, aged (adult/juvenile), weighed, and identified to its species if possible. A ruler should be used to measure the head-body length, ear (from skull to tip), tail, and right hind foot to the nearest millimeter. The animal should then be returned for release to the location it was trapped. All information should be recorded on the data sheet.

Tissues will be collected for chemical and radiological analysis, genetics, and histopathology. On the last day of the population surveys, at least three deer mice in each grid will be retained as a single composite sample. Animals to be sacrificed for contaminant analysis will be dispatched in the field. After dispatch, each carcass will be weighed and placed in another clean plastic bag. The amount of sample material in the composite sample will be determined by summing the weights of the individual specimens from each location. Processing should take place as soon as possible after checking traps to reduce potential degradation of the specimen. Samples will be placed on ice for transport to the processing center.

Portions of each animal's liver and kidney will be collected for histopathology. A ventral incision will be made with a clean scalpel blade. Small sections of the liver and kidney will be removed, weighed to the nearest 0.01 g, and placed in a 10% buffered formalin. This solution is potentially carcinogenic and should be handled with caution that is detailed on the respective material safety data sheets. The jar will be labeled with appropriate sample information (i.e., time, date, and sample identification number). Small sections of maternal and fetal tissue will be removed from female mice. The carcasses will be placed in a sealable plastic bag and placed inside another bag with the sample labeled. Chain-of-custody forms will be filled out.

Tissue samples for residue analysis should be frozen and shipped on Blue Ice (or equivalent) to the laboratory. Dry ice can cause serious skin burns if handled incorrectly. Gloves should be worn when handling dry ice.

A single voucher specimen will be photographed but will not be analyzed for contaminants. An experienced wildlife biologist will examine the voucher specimen to verify genus and species.

B2.2 Soil Analytical Characterization

Soil samples will be collected from the surface 0 to 5 cm (0 to 2 in.) and subsurface 5 to 61 cm (2 to 24 in.) or bedrock (i.e., limited to two sampling intervals) and will consist of composites from locations within the sampling plot designs that correspond to plants from which vegetation samples are collected.

Before sampling, it is important to calculate the total volume of sample material that will be needed from each increment sample location to ensure that the volume required for each analysis is available to completely fill each sample container. The analysis-specific volumes are specified in the Appendix A field guidance forms. Sampling locations specified will be identified and marked using surveying stakes, lath, or flags. The soil will be evaluated for contamination concentrations.

B2.2.1 Surface Soil Material

Composite surface material samples will comprise five increment subsamples collected from each of the corners and center point of a 100-m (110-yd) square. All or a portion of the increment samples will be mixed together to create a composite sample representative of average constituent concentrations within the area to be characterized. For a given composite sample, the volume of each increment sample must be the same and must equal 1/n of the required composite sample volume, where n equals the number of increment samples making up the composite sample.

Surface material samples will be collected as follows:

1. At each subsample location, an area approximately 61 cm (24 in.) in diameter is cleared of surface vegetation, nondecomposed plant litter, and debris.

2. A decontaminated stainless-steel spoon or hand auger is used to collect surface material to a depth of 5 cm (2 in.). A stainless-steel pick can be used as needed to loosen the soil. To the extent possible, gravel-size or larger particles and debris are eliminated, based on visual observation.

3. The material is described visually, and observations are recorded on the soil sample field data sheet.

4. The increment sample is sieved through a No. 10 mesh, and the fine fraction is placed into a decontaminated stainless-steel mixing bowl and then thoroughly mixed.

5. For composite samples, Steps 1 through 4 are repeated at each increment sample location for that composite sample, adding each successive increment sample to the mixing bowl.

6. The sample material is thoroughly mixed in the stainless-steel bowl using a decontaminated stainless-steel spoon. To homogenize the sample, it is divided into four quarters, and each quarter is mixed; then the four quarters are combined, and the entire sample is mixed. The mixture is placed into the appropriate laboratory-supplied sample containers.

7. The containers are labeled and handled as required. Soil subsample location descriptions and collection information will be documented in the logbook in accordance with Management Control Procedure (MCP) -1194, “Logbook Practices for ER and D&D&D Projects.”

B2.2.2 Subsurface Soil Material

Subsurface material samples will be collected as composite samples. Before sampling, it is important to calculate the total volume of collected sample material at each increment sample location to ensure that the volume required for each analysis is available to completely fill each sample container. The analysis-specific volumes are specified in the Appendix A field guidance forms. Specified sampling locations will be identified and marked using surveying stakes, lath, or flags.

Composite surface material samples will comprise five increment subsamples collected from each of the corners and center point of a 100-m (110-yd) square. All or a portion of the increment samples will be mixed together to create a composite sample representative of average constituent concentrations within the area to be characterized. For a given composite sample, the volume of each increment sample must be the same and must equal 1/n of the required composite sample volume, where n equals the number of increment samples making up the composite sample.

Subsurface material samples are collected as follows:

1. At each sample location, an area approximately 61 cm (24 in.) in diameter is cleared of surface vegetation (nondecomposed plant litter) and debris.

2. A decontaminated stainless-steel spoon or hand auger is used to collect subsurface material from a depth of 5 cm (2 in.) to no more than 61 cm (24 in.) below ground surface. A stainless-steel pick can be used as needed to loosen the soil. To the extent possible, gravel-size or larger particles and debris are eliminated based on visual observation. Depth must be recorded for each soil core collected.

3. The material is visually described, and observations are recorded on the soil sample field data sheet.

4. The increment sample is sieved through a No. 10 mesh, and the fine fraction is placed into a decontaminated stainless-steel mixing bowl and then thoroughly mixed.

5. For composite samples, Steps 1 through 4 are repeated at each increment sample location for that composite sample, adding each successive increment sample to the mixing bowl.

6. The sample material is thoroughly mixed in the stainless-steel bowl using a decontaminated stainless-steel spoon. To homogenize the sample, it is divided into four quarters, and each quarter is mixed; then the four quarters are combined, and the entire sample is mixed. The mixture is placed into the appropriate laboratory-supplied sample containers.

7. The containers are labeled and handled as required. Soil subsample location descriptions and collection information will be documented in the logbook in accordance with MCP-1194.

The center of the sample grid location will be surveyed using a Global Positioning System unit.

B2.3 Soil Nutrient and Physical Characterization

Soil samples for soil nutrient and physical characterization will be collected at the same time and same locations as soil samples for contaminant analysis. Each composite sample will be collected as follows:

- Soil sampling sites will be collocated with chemical and radiological soil samples.

- After collection of the chemical analysis samples (described above), appropriate amounts of homogenized soil will be placed into the shipping containers for analysis. Approximately 500 g will be placed into a sealable plastic bag for soil-nutrient and physical characterization.

- The containers will be labeled and handled as specified by the field sampling plan (FSP).

These procedures can be modified in the field, as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

B3. EFFECTS SAMPLING

B3.1 Population/Community Data

Ecological systems such as populations or communities are usually quite large and complex. These systems must be described and quantified to compare them with one another or assess changes in them. Several ecological variables can be measured (such as density, frequency, coverage, and biomass) to describe populations and communities. These measurements are used to characterize aspects of populations and communities such as presence/absence, population density, population distribution, species diversity, and productivity (biomass).

B3.1.1 Vegetation

Fifty Daubenmire quadrats will be collected at each of the 10 AOC plots. Transects will be located between each of the 10 trapping line (see Figure B-1) in each 100 × 100 m plots. Each transect line will have five quadrat locations spaced approximately 2 m (6 ft) apart. These locations will be selected by striding 20 to 25 paces between quadrats starting at the edge of the 100 × 100 m plot. The quadrat frame will be placed with the left side of the short end of the frame at the edge of the right foot. A 1- × 3-m (1.1-× 3.3-yd) quadrat will be used to estimate percent ground cover. As the quadrat frame is placed along the tape at the specified intervals, the canopy coverage of each plant species will be estimated. In addition, the data will be recorded by quadrat, species, and cover class. Canopy coverage can be estimated, as follows, for both perennial and annual plant species:

1. The quadrat frame is observed directly from above, and the cover class for all individuals of a plant species in the quadrat is estimated as a unit. All other kinds of plants are ignored as each plant species is considered separately.

2. A line drawn about the leaf tips of the undisturbed canopies (ignoring inflorescence) is imagined, and these polygonal images are projected onto the ground. This projection is considered “canopy coverage.” The classes that the canopy coverage of the species falls into can be determined (see Table B-1).

3. Canopies extending over the quadrat are estimated even if the plants are not rooted in the quadrat.

4. The data are collected during a period of maximum growth for key species.

5. For tiny annuals, it is helpful to estimate the number of individuals that would be required to fill 5% of the frame. A quick estimate of individuals in each frame will then provide an estimate as to whether the aggregate coverage falls in Class 1 or 2, etc.

6. Overlapping canopy cover is included in the cover estimates by species; therefore, total cover might exceed 100%. Total cover might not reflect actual ground cover.

Table B-1. Plant cover classes.

Coverage Class	Range of Coverage (%)	Midpoint of Range (%)
1	0 to 5	2.5
2	6 to 25	15.0
3	26 to 50	37.5
4	51 to 75	62.5
5	76 to 95	85.0
6	95 to 100	97.5

While using this method, it is important to keep track of the growth form of each species so that comparisons of grass vs. forb vs. shrub can be made. In addition, an estimation of the cover of bare ground and rocks will provide additional characterization data. While conducting this survey, it is important to remember to record total cover for each quadrat, because this might differ from the sum of the cover values for individual species (due to plant canopy overlap). The surveyor should have a cover category for each quadrat among all identifiable species, mosses (if any), bare ground, rocks, and total cover.

Within each quadrat, the shrub height will be measured by species. To measure shrub height, one person will hold a telescoping rod or other measurement device in the center of a shrub while the other person records the height. If no shrub is present within the plot, the closest shrub(s) to the quadrat of each of the dominant species will be measured.

Once the surveys are complete, the species cover can be estimated by multiplying the number of times a class is recorded by the midpoint of that cover class, adding the results for each class, and calculating an average by dividing by the total number of quadrats sampled. Data are usually collected from many quadrats located along a transect, so that the transect is the sample unit. Therefore, data must be collected from several transects to determine the sample's precision for statistical analysis of cover data.

This method recognizes the difficulty in accurately assigning an exact percent cover value to each quadrat, because even highly experienced workers are unlikely to visually estimate closer than about 5% cover. Assigning broad cover classes provides an equally accurate result as long as the data follow a normal distribution around the midpoint within each class. The narrower upper and lower classes of the Daubenmire scale protect against skewed data in extremely sparse or dense vegetation.

Ranking the data into broad classes is also a relatively rapid procedure, because observers are not required to spend as much time contemplating quadrat cover to the nearest percent. In fact, rapid evaluation of each quadrat is the key to success with this approach, since a large sample is less sensitive to the occasional incorrect ranking.

B3.1.2 Birds

The Breeding Bird Survey is a roadside survey of avifauna designed to monitor abundance and distribution of birds in the United States and southern Canada. Routes have been established and used at the INEEL (Belthoff and Ellsworth 1999). The methodology used in this FSP will be adapted to the sampling presented in Belthoff and Ellsworth (1999). Additional evaluation of bird population/community data will be incorporated as a selected study in an area of known contamination.

B3.1.3 Mammals

Small mammals will be evaluated by using live trapping methods. The 10 sample plots established for biota and soil analytical sampling will be used to assess the small mammal population/community data in the sampling area. Each sample plot will require a 2- to 3-week trapping period and will consist of 100 traps placed along 10 transect lines (10 traps on each) in a line grid formation. Each of the transects will approximately follow a 100-m-long (110-yd-long) straight line. An example of the transect design is shown in Figure B-1.

Traps will be left open 4 nights, closed 3 nights, and then reopened an additional 4 nights. Once an animal is trapped, a uniquely numbered ear tag will be attached. The ear tag will correlate with the trap location, genus, species, collector's initials, and date recorded in a field logbook. The animal should be emptied into a plastic bag. It should be sexed, aged (adult/juvenile), weighed, and identified to its species if possible. A ruler should be used to measure the head-body length, ear (from skull to tip), tail, and right hind foot to the nearest millimeter. The animal should then be released to the original location from where it was trapped. All information should be recorded on the data sheet.

The mark-and-recapture method will be used in estimating population densities. This method involves several steps:

1. Trapping and marking some individuals of a population

2. Releasing the known number of marked individuals back into the population from which they were captured

3. Trapping some individuals of the population after the marked individuals have had a chance to redistribute themselves into the population

4. Estimating the total population size by a series of computations that are based on the ratio of marked to unmarked individuals in the recapture attempt.

Generally speaking, if the population is large, the marked individuals will become diluted within the population, and only a few of the marked individuals would be expected to appear in the second sample. If assumptions about the sampling and animals' distribution are correct, then the proportion of marked individuals in the second sample would be the same as the entire population.

Like all estimation procedures, a number of assumptions must be met to validly use this method:

- The two samples taken from the population must be random samples (i.e., all individuals in the population have an equal and independent chance of being captured during the time of sampling).

- There is no change in the ratio of marked to unmarked animals, meaning that from initial capture to recapture, there must be no significant addition of unmarked animals to the population through births or immigration.

- The population losses from mortality and emigration must remove the same proportion of marked and unmarked individuals.

- The marking of individuals does not affect their mortality.

- Individuals do not lose marks.

The Peterson-Lincoln Index, the simplest method for determining the population size, will be used. The total population can be estimated as follows:

- Assume the total estimated population size contains N individuals.
- Sample M individuals from this population, mark these animals, and return them to the population.
- Sample a second set of n individuals from the population; this sample contains recaptured animals (i.e., individuals captured and marked in the first sampling).
- Estimate the population size, N, by the following equation.

$$N = Mn / R \quad . \tag{B-1}$$

Equation (B-1) might overestimate the population size (i.e., it is biased) when samples are relatively small. Nc is a nearly unbiased estimate of population size if the number of recaptured animals, R, is at least eight. Using the following equation can reduce this bias:

$$Nc = \frac{(M+1)(n+1)-1}{R+1} \quad . \tag{B-2}$$

The approximate variance, s^2, of this estimate is as follows:

$$s^2 = \frac{(M+1)(n+1)(M-R)(n-R)}{(R+1)^2(R+2)} \quad . \tag{B-3}$$

With the standard deviation, s, 95% and 99% confidence limits on the population estimate are given by the following:

N (or NC) + 1.96(s)(95% confidence limits) (B-4)

and

N (or NC) + 2.58(s)(99% confidence limits). (B-5)

B3.1.4 Reptiles

Collection of small mammals will provide an indication of possible exposure of reptiles to contamination in the soil. Population information will be collected for these receptors that is consistent with the direction in the *Record of Decision Experimental Breeder Reactor-I/Boiling Water Reactor Experiment Area and Miscellaneous Sites* (DOE-ID 2002a). Collection will occur during future field seasons under the LTEM Plan (INEEL 2004) and will use university experts in the design of the project.

B3.2 Earthworm and Plant Bioassay Soil Samples

Bioassay soil samples will be collected at the same time and same locations as soil samples. Each composite sample will be collected as follows:

- Soil sampling sites will be collocated with chemical and radiological soil samples
- After collection of the chemical analysis samples (described above), appropriate amounts of homogenized soil will be placed into the shipping containers for the bioassays
- Containers will be labeled with the date, location, and other appropriate information and shipped on ice to the bioassay laboratory for processing.

These procedures can be modified in the field, as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

B3.3 Soil Invertebrate Community Survey Soil Samples

Soil samples for invertebrate community structure will be collected at the same time and same locations as soil samples for analysis. Each composite sample will be collected as follows:

1. Soil sampling sites will be collocated with the chemical and radiological soil samples.
2. After collection of the samples for chemical analysis, appropriate amounts of homogenized soil will be placed into shipping containers for the Berlese funnel extraction. Approximately 500 g of soil will be placed into a sealable plastic bag for Berlese funnel extraction to conduct soil fauna community analysis.
3. Large invertebrates will be removed from the soil sample.
4. The soil sample will be placed in a funnel under a 40-watt light bulb. The lamp above the soil creates a warm, dry, and well-illuminated condition at the top of the funnel, encouraging cool-, shade-, and moisture-loving invertebrates to move down the funnel into a collecting bottle containing a preservative (i.e., 80% ethanol).
5. The Berlese funnel technique gives a biased sample of soil fauna, because it captures species that are mobile and do not desiccate easily. Therefore, the Berlese funnel might miss many insect larvae and other soft-bodied invertebrates.
6. The containers will be handled and labeled with the date, sample location, and other information as appropriate.

These procedures can be modified in the field, as appropriate, based on the professional judgment of the FTL. All modifications will be documented in the field logbook or on the field sampling data sheets.

B3.4 Histopathology and Body and Organ Weight

Tissue will be collected from small mammals for chemical and radiological analysis, genetics, and histopathology. On the last day of small-mammal population surveys (see Subsection B3.1.3), at least three deer mice in each sampling plot will be retained as a single composite sample. Deer mice will be taken to the laboratory and humanely killed. Immediately before processing, live animals should be killed by cervical dislocation or asphyxiation with carbon dioxide gas. Animals should be removed from traps one at a time, so that specimens are not misidentified. Processing should take place as soon as possible after trap checks to reduce potential degradation of the specimen. The deer mice will be weighed to the nearest 0.1 g.

A ventral incision will be made with a clean scalpel blade. Small sections of liver and kidney will be removed for histopathology and weighed to the nearest 0.01 g and then placed in 10% buffered formalin. This solution is potentially carcinogenic and should be handled with caution, as detailed on the material safety data sheet. The jar will be labeled with appropriate sample information (time, date, sample identification number, and ear tag number).

Small sections of maternal and fetal tissue will be removed from female mice for genetics analysis. The three carcasses forming the single composite sample will be placed in a sealable plastic bag, placed inside another bag, and then labeled for contaminant analysis. Chain-of-custody forms will be filled out.

The removal of the kidney and liver may reduce apparent concentrations slightly. Estimated loss in concentration is as shown in Equation (B-6):

$$mg/kg\ WB * kg\ WB + mg/kg\ L * kg\ L + mg/kg\ k * kg\ k \quad \text{(B-6)}$$

where:

mg/kg WB = concentration in whole body

mg/kg L = concentration in liver (estimated)

mg/kg k = concentration in kidney (estimated).

A bioaccumulation factor from the literature will be used to estimate the fraction lost to histopathology. Although the bioaccumulation factor introduces uncertainty into the assessment, the liver and kidney tend to concentrate metals and might exhibit cellular changes for evaluation of effects from exposure. If effects are determined to be present, a selected study will be performed to further characterize this problem, or the sampling approach will be modified appropriately.

B4. AQUATIC ECOSYSTEM CHARACTERIZATION

Mackay Reservoir was selected as the aquatic reference area.

B4.1 Sediment and Surface Water Analytical Sampling

Sediment and surface water samples will be obtained from the reference area and from the waste ponds at the TAN TSF-07 if water is available. The data will be used to predict health effects and exposure in aquatic receptors. Five grab samples of each media will be collected from a 10-m^2 (108-ft^2) grid surrounding the pond. If water is unavailable, the TAN TSF-07 disposal pond will be treated as a terrestrial sampling area.

B4.2 Biota Analytical and Effects Sampling

If appropriate aquatic receptors are present, they will be collected and identified to the lowest taxonomic level possible. Sixty grams is required for all analytical work. Five samples will be collected from the pond.

Arian effects will be measured by surveying nests in the spring. The number of eggs in up to 20 nests will be counted. The number of eggs that hatch will be counted by observing the nests on a daily basis to obtain a measure of hatching success. To obtain a measure of growth and reproductive success, young birds will be weighed soon after hatching and again as flight feathers appear. Birds will be gently placed into a soft cloth bag and weighed on a field balance. Before complete fledging, one bird from each nest will be collected for analysis. Data will be compared to that from the aquatic reference area.